

**Final Hydraulic Report
Van Duzen – Peanut Road
CA SR 36 (13)**



Prepared by
Veronica Ghelardi
Technical Services Hydraulic Engineer
Central Federal lands Highway Division
Lakewood, Colorado
December, 2014

TABLE of CONTENTS

INTRODUCTION	3
PROJECT BACKGROUND AND OBJECTIVES	3
ROADWAY HYDRAULIC DESIGN STANDARDS.....	3
VAN DUZEN FLOODPLAIN ANALYSIS.....	4
Federal Emergency Management Agency (FEMA) Floodplain Mapping	4
Hydrology.....	4
Hydraulic Analysis	6
Existing Conditions.....	6
Proposed Conditions.....	8
CULVERTS	10
Proposed Culvert Hydrology and Sizing.....	10
Burr Creek	11
SUMMARY.....	12
Floodplain/Roadway.....	12
Culverts	13
REFERENCES	14
APPENDIX A.....	15
APPENDIX B.....	18

Figures

Figure 1. Project Site Location Map	3
Figure 2. Boundaries of the California Flood-Frequency Regions and Regression Equations	5
Figure 3. Existing Water Surface Elevation at Road Overtopping Location	7
Figure 4 Water Surface Elevation at River Station 1703 (Proposed MP 2090+00).....	9

Tables

Table 1. Hydraulic Standards	4
Table 2. Van Duzen Bridge Basin characteristics	5
Table 3. Regional Flood Frequency Equations for North Coast Region - California.....	6
Table 4. USGS Regression Equation Calculated Bridge Discharges.....	6
Table 5. HEC RAS Existing Bridge Water Surface Elevations	8
Table 6. Difference in Water Surface Elevations between Existing and Proposed Conditions	10
Table 7. Proposed Stream Crossing Culvert Locations, Discharges and Sizes	11
Table 8 Burr Creek Culvert Options	12

INTRODUCTION

The purpose of this report is to provide: 1) hydrologic analysis for the bridge on the northern end of the project, 2) the effects of the proposed road re-alignment on the existing floodplain limits, and 3) recommendations of the proposed stream culvert sizes.

PROJECT BACKGROUND AND OBJECTIVES

The project is located on State Road 36 Humboldt County project in, Humboldt County California. The road provides access between California's coast and interior by providing an important road link between U.S. 101 and Interstate 5. Figure 1.



Figure 1. Project Site Location Map

The existing roadway is heavily used by tourists and commuters, even though there are sections of the road that operate at 12 mph. The main purpose of the project is to upgrade the operating speed along the 4.4 miles of the project by re-aligning the roadway.

ROADWAY HYDRAULIC DESIGN STANDARDS

The Central Federal Land's Project Development Design Manual (PDDM) considers a highway a high-standard road if the Average Daily Traffic (ADT) is ≥ 1500 vehicles /day. Since the ADT on SR 36 is more than 1500 vehicles/day, it is considered a high standard road. In addition the requirements of the Regional Water Quality Control Board's (RWQCB) hydraulic standards (culverts should be designed to be 2/3 full for the 100-yr flood event) were used for all cross culverts on this project except for the Burr Creek culvert. The CALTRANS Regional Hydraulics Engineer stated that CALTRANS would not typically use the Water Board requirements for culverts to be 2/3 full for the 100-yr event. CALTRANS standard is

to design the culverts so that the road is not overtopped by the 100-yr flood event. It was decided by the cross functional team that the cross culverts would still be designed to the Water Board's standard so that the road would not be flooded in extreme weather events. The only exception to the Water Board's standard is the Burr Creek culvert. The existing Burr Creek culvert is 8 ft in diameter. To design a culvert at this site to be only 2/3 full for the 100-yr flood event would be too costly. Therefore, this culvert was designed to the CFL standard of a headwater to diameter ratio(HW/D), which for culverts larger than 48 inches is equal to 1.2. Table 1 shows the standards used in the design of the culverts and ditches.

Feature	Capacity Design	Stability Design	Scour Check Flood
Bridge	50-yr flood event	100-yr	200-yr
Cross Culverts	100-yr (flowing 2/3 full)	NA	NA
Burr Creek Culvert	100-yr event (HW/D = <1.2)	NA	NA
Roadside Ditch	10-yr	10-yr	NA

Table 1. Hydraulic Standards

VAN DUZEN FLOODPLAIN ANALYSIS

Federal Emergency Management Agency (FEMA) Floodplain Mapping

A search for the FEMA Flood Insurance Rate map (FIRM) found that the study area of the Van Duzen River is defined as a Zone A. FEMA Zone A maps only estimate the limits of the base floodplain (100-yr flood). No engineering studies were conducted and no base flood elevations were determined by FEMA. To determine any impacts of the proposed conditions, an existing-conditions hydraulic model must be developed and compared to the proposed conditions model. If there is more than a one foot increase in the base flood elevations between the existing and proposed conditions models, a Conditional Letter of Map Revision (CLOMR) must be submitted to FEMA. Once the CLOMR is approved by FEMA, the project may be constructed and a Letter of Map Revision (LOMR) would then be submitted to FEMA within 60 days of the end of construction.

Since the bridge will not be replaced, the purpose of the hydraulic analysis is to define the downstream floodplain water surface elevations that currently exist and determine if the current road alignment is overtapped. The intent of this analysis is to confirm a less than 1 foot rise in the 100-year water surface levels due to any road re-alignment and to ensure that the proposed new road realignment does not negatively impact the floodplain.

Hydrology

The USGS StreamStats website was used to obtain the drainage area and basin characteristics including the mean annual precipitation. The site also was used to obtain the updated USGS regression equations for the North Coast Region of California (Figure 2) to compute the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year peak discharge estimates . Table 2 shows the drainage area calculated for the bridge at the north end of the project and the mean annual precipitation:

Drainage Area (square miles)	80.6
Mean Annual Precipitation (inches)	74.2

Table 2. Van Duzen Bridge Basin characteristics



Figure 2. Boundaries of the California Flood-Frequency Regions and Regression Equations

Table 3 shows the 2012 USGS regression equations for the North Coast Region of California used to calculate the peak discharge at the bridge location. Table 4 shows the results of the calculated discharges for the various return periods based on those equations.

Table 5. Regional flood-frequency equations for rural ungaged streams in California.[mi², square miles; DRNAREA, drainage area, in mi²; PRECIP, mean annual precipitation, in inches; ELEV, mean basin elevation, in feet]

Percent annual exceedance probability	Hydrologic region (shown in pl. 1)		
	North Coast (Region 1)	Lahontan (Region 2)	Sierra Nevada (Region 3)
50	$1.82(DRNAREA)^{0.904}(PRECIP)^{0.983}$	$0.0865(DRNAREA)^{0.736}(PRECIP)^{1.59}$	$2.43(DRNAREA)^{0.924}(ELEV)^{-0.646}(PRECIP)^{2.06}$
20	$8.11(DRNAREA)^{0.887}(PRECIP)^{0.772}$	$0.182(DRNAREA)^{0.733}(PRECIP)^{1.58}$	$11.6(DRNAREA)^{0.907}(ELEV)^{-0.566}(PRECIP)^{1.70}$
10	$14.8(DRNAREA)^{0.880}(PRECIP)^{0.696}$	$0.260(DRNAREA)^{0.734}(PRECIP)^{1.59}$	$17.2(DRNAREA)^{0.896}(ELEV)^{-0.486}(PRECIP)^{1.54}$
4	$26.0(DRNAREA)^{0.874}(PRECIP)^{0.628}$	$0.394(DRNAREA)^{0.733}(PRECIP)^{1.58}$	$20.7(DRNAREA)^{0.885}(ELEV)^{-0.386}(PRECIP)^{1.39}$
2	$36.3(DRNAREA)^{0.870}(PRECIP)^{0.589}$	$0.532(DRNAREA)^{0.733}(PRECIP)^{1.58}$	$21.1(DRNAREA)^{0.879}(ELEV)^{-0.316}(PRECIP)^{1.31}$
1	$48.5(DRNAREA)^{0.866}(PRECIP)^{0.556}$	$0.713(DRNAREA)^{0.731}(PRECIP)^{1.56}$	$20.6(DRNAREA)^{0.874}(ELEV)^{-0.250}(PRECIP)^{1.24}$
0.5	$61.0(DRNAREA)^{0.863}(PRECIP)^{0.531}$	$0.944(DRNAREA)^{0.729}(PRECIP)^{1.55}$	$19.4(DRNAREA)^{0.870}(ELEV)^{-0.188}(PRECIP)^{1.18}$
0.2	$79.3(DRNAREA)^{0.860}(PRECIP)^{0.503}$	$1.35(DRNAREA)^{0.727}(PRECIP)^{1.52}$	$17.4(DRNAREA)^{0.865}(ELEV)^{-0.110}(PRECIP)^{1.11}$

Table 3. Regional Flood Frequency Equations for North Coast Region - California

Return Period	Discharge (cfs)
2-yr	6640
5-yr	11100
10-yr	14100
25-yr	18019
50-yr	20900
100-yr	23800
500-yr	26500

Table 4. USGS Regression Equation Calculated Bridge Discharges

Hydraulic Analysis

Existing Conditions

Reports from the FHWA Northern California Resident Engineer indicate that approximately 2000 feet downstream of the Van Duzen bridge across the Van Duzen River, the road is overtopped during large storm events. A bridge hydrologic and hydraulic analysis were performed to determine any effects the bridge might have on the downstream water surface elevations and to determine where the roadway is overtopped.

The U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center River Analysis System (HEC-RAS) version 4.1, 2010 software was used to analyze the existing hydraulic conditions and to determine the existing floodplain boundaries. Cross sections for the hydraulic model were cut from LIDAR

elevation data in the MicroStation project file. The hydraulic model extended upstream from the existing bridge 1150 feet and downstream from the bridge approximately 2555 feet. The bridge configuration was based on “as-built” drawings obtained from CALTRANS.

It has been reported that an area of the roadway approximately 2000 feet downstream from the existing bridge has experienced flooding after major storms. The existing HEC RAS model did show that the 100-year flood event overtopped the road in the area of concern, Figure 3.

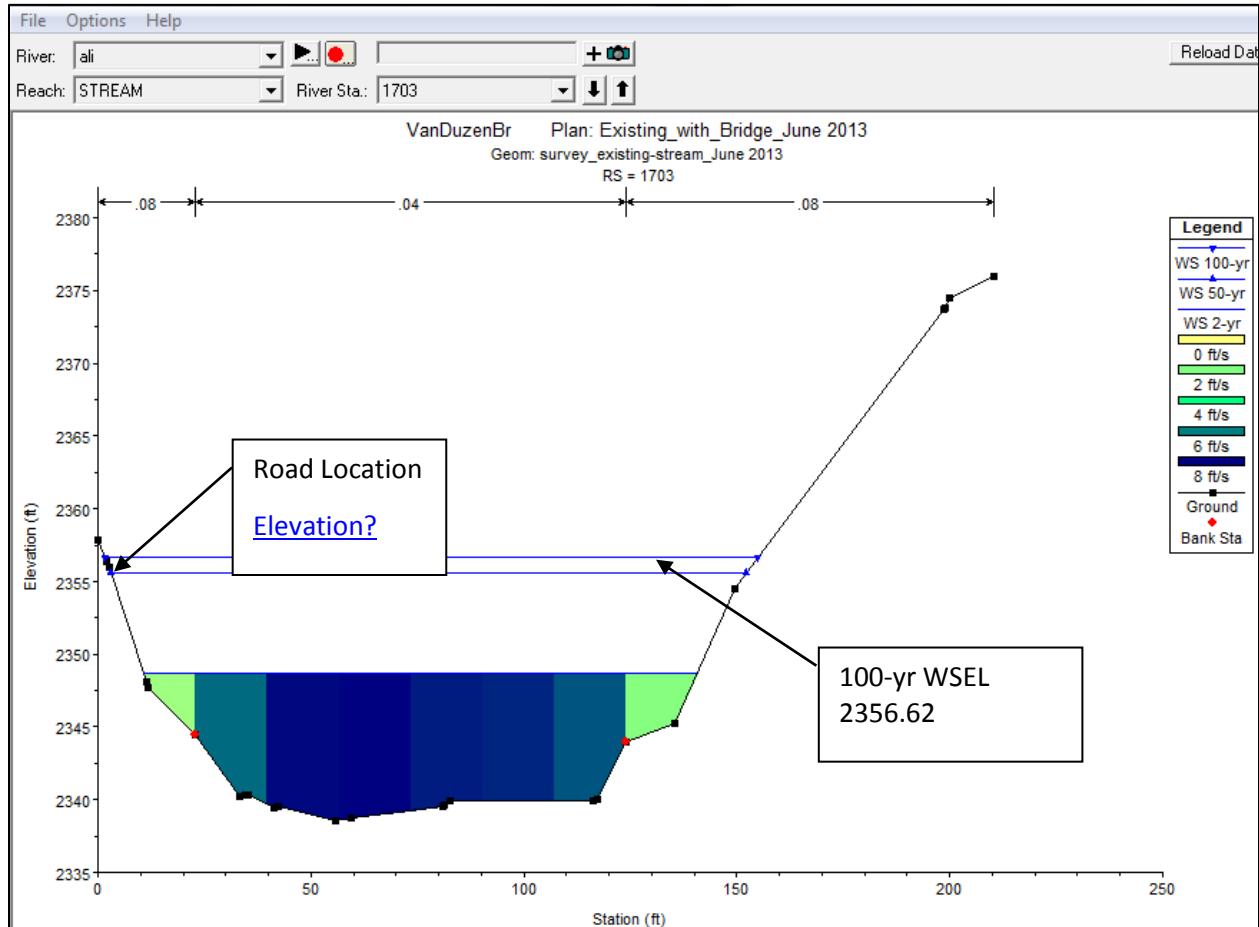


Figure 3. Existing Water Surface Elevation at Road Overtopping Location

Table 5 shows the existing 100-year water surface elevations. The road is overtopped between hydraulic cross sections 1325 and 1703 by approximately 2 feet of water with the low point elevation of the road being 2355 feet on the streamside road edge.

Q Total (cfs)	River Station	Water Surface Elev. (ft)
23800	5076	2373.53
23800	4854	2373.28
23800	4635	2367.79
23800	4365	2368.90
23800	4067	2367.44
23800	4013	2367.77
Bridge	4000	
23800	3965	2366.09
23800	3915	2362.97
23800	3816	2362.29
23800	3697	2362.40
23800	3435	2361.11
23800	3292	2361.89
23800	3008	2360.64
23800	2810	2359.95
23800	2491	2359.32
23800	2192	2358.32
23800	1703	2356.62
23800	1325	2351.80
23800	1101	2350.52

Table 5. HEC RAS Existing Bridge Water Surface Elevations

Proposed Conditions

The re-alignment of SR 36 was analyzed to determine if the re-alignment would cause a water surface elevation rise in the floodplain downstream of the bridge in the area where overtopping of the road currently occurs during major storm events. The proposed HEC RAS model was based on the existing HEC RAS model. The re-alignment affected river cross sections 1325, 1703, 2192, 2491, 2810, 3008, 3292, 2435, 3697, and 3816 so these cross sections were modified to reflect the new road alignment. The proposed model showed that the new alignment caused a less than 1 foot rise in the 100-year water surface elevation and that the proposed roadway is not overtopped between river cross sections 1325

and 1703 (Proposed MP 2090+00). The biggest rise of 0.09 ft. occurred at river cross section 2491. See Table 7.

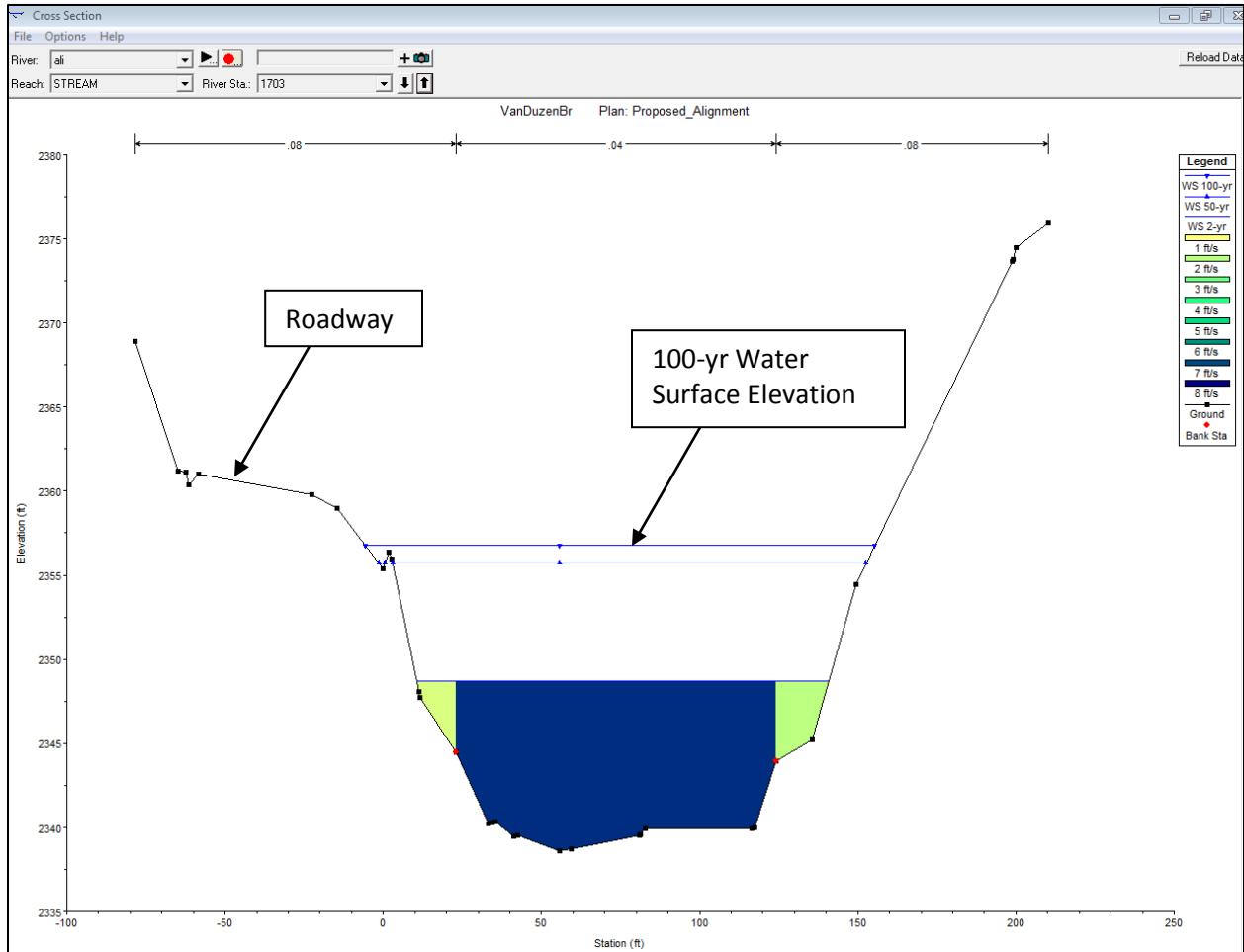


Figure 4 Water Surface Elevation at River Station 1703 (Proposed MP 2090+00)

River Station	Existing Water Surface Elevation (ft)	Proposed Re-Alignment Water Surface Elevation (ft)	Difference in Water Surface Elevations (ft)	Proposed Roadway Elevation (ft)
5076	2373.53	2373.53	0	
4854	2373.28	2373.28	0	
4635	2367.79	2367.79	0	
4365	2368.90	2368.90	0	
4067	2367.44	2367.44	0	
4013	2367.77	2367.77	0	
Bridge				

3965	2366.09	2366.09	0	
3915	2362.97	2362.97	0	
3816	2362.29	2362.30	0.01	
3697	2362.40	2362.41	0.01	
3435	2361.11	2361.13	0.02	
3292	2361.89	2361.91	0.02	
3008	2360.64	2360.66	0.02	
2810	2359.95	2359.97	0.02	
2491	2359.39	2359.48	0.09	
2192	2358.32	2358.36	0.04	
1703	2356.62	2356.69	0.07	2360
1325	2351.80	2351.80	0	2365
1101	2350.52	2350.52	0	

Table 6. Difference in Water Surface Elevations between Existing and Proposed Conditions

CULVERTS

Proposed Culvert Hydrology and Sizing

The proposed road alignment, contours and roadway stationing (Microstation dgn file) were saved as a dwg and imported into WMS. This file was then merged with the existing Digital Elevation Model (DEM) file in WMS. From this merged elevation file the flow accumulation routine was run to determine where concentrated channel flow would occur with a drainage area of at least 0.5 acre. Outlets were placed where the flow accumulation intersected the new road profile and the drainage area of each outlet was calculated by WMS.

The outlets/stream crossings discharges were determined by the Rational Method for all drainage areas less than 200 acres using the FHWA Hydraulic Toolbox. Only one drainage area, Burr Creek (MP 1970+16), was larger than 200 acres and the North Coast Regression equation was used to determine the discharge for this drainage area. The FHWA HY-8 culvert sizing program was used to size all culverts. The results are summarized in Table 6 below.

The dwg and DEM files did not provide a smooth transition between the elevation files so the inlet and outlet invert elevations were determined from the original Microstation dgn file of the proposed alignment and contours. This file did not extend far enough in some cases to determine the correct inlet invert elevation so the most reasonable elevation was used from the proposed contour files. In most cases this resulted in the roadway profile being too low to accommodate the culverts.

Update: during the 70% site visit all proposed culvert locations were scouted to check whether culverts were needed in every culvert location. Several culvert locations revealed that there was no concentration of flow so these culverts were deleted from the list. Table 7 shows the updated stream culvert stations, drainage areas, and sizes for the 100-year design event (except the Burr Creek 10 ft. CMP pipe which is designed for the 50-year event).

Proposed Mile Post	DA (acres)	100-yr (cfs)	Invert Elev (ft)	Outlet Elev (ft)	HW Elev (ft)	HW/D	Culvert size
1905+31	12	11	2581.5	2580	2.13	0.51	36"
1917+31	107	86.5	2636	2625	4.85	1.21	48"
1932+00	147	109	2738	2735	4.8	1.07	54"
1935+39	7	18.3	2809	2763	2.85	0.82	30"
1956+22	6	4.5	2900.5	2873	0.68	0.34	24"
1957+99	11	7.1	2883	2862	1.25	0.63	24"
1959+72	11	6.8	2873	2833	1.48	0.99	18"
1966+66	6	17.1	2821.5	2820	2.23	0.90	30"
1968+81	1076	840	2784	2720	10.92	1.07	10' CMP
1974+89	13	9.4	2752.2	2690.6	1.45	0.73	24"
1977+13	4	3.3	2740	2700	0.63	0.46	18"
1984+66	25	30	2711	2708	2.88	0.96	36"
1999+06	78	60	2615	2598	4.11	1.17	42"
2001+97	5	6	2572.5	2563	1.5	1.0	18"
2014+36	115	76	2480	2475	2.83	0.44	6x4
2023+46	152	94	2497	2491	3.06	0.77	48"
2048+58	94	48	2534.5	2532	2.46	0.82	36"
2051+60	23	23.8	2524	2508	2.73	1.40	30"
2054+19	13	60	2528	2523	2.92	0.58	60"
2075+23	181	147.8	2442	2437.	5.2	1.04	60"
2087+14	5	6	2357	2355	1.35	0.90	18"
2089+35	53	50.9	2350	2345	3.97	1.33	36"

Table 7. Proposed Stream Crossing Culvert Locations, Discharges and Sizes

All the proposed cross culverts except the Burr Creek culvert, were sized to accommodate the 100-year flood event and remain in the acceptable HW/D ratio of 1.5 for culverts < 48". The Burr Creek culvert has a HW/D ratio of 1.07 The acceptable ratio for culverts >48" is HW/D = 1.2.

Burr Creek

The existing Burr Creek culvert is an 8 foot diameter CMP pipe on an 33% +slope with headwalls , wingwalls and upstream concrete apron on a steep slope to the culvert. Approach flow must make a 90 degree turn to flow into the culvert. Upstream of the culvert the stream descends through a steep ravine with slope stability issues that cause heavy debris to accumulate near the culvert entrance. In addition the road to the right of the culvert (orientation looking downstream) is situated on a slide area; however, the culvert itself is out of the slide area. Observation of low flow discharges reveal that low flow does not enter the existing culvert inlet. Several feet upstream of the culvert low flows become subsurface. However, at least a portion of this flow is entering somewhere in the middle of the culvert as water can be seen discharging at the outlet. Any new culvert or culvert replacement will need to add

a cutoff wall at the culvert inlet to address the piping issue. The water discharging from the culvert outlet has formed a natural stilling basin at the outlet with large rocks surrounding the basin. Downstream of the stilling basin the channel continues on a more mild slope of 2-4% for about 75 feet with large rocks in the channel. From there the channel continues on a steep gradient.

Several culvert replacement/rehabilitation options were analyzed including structural steel arch plate, CMPs, box culverts and lining the existing culvert. The generic culvert slipliner was assumed to be a slick, plastic liner with a low n value in the 0.01 range. The following culvert options were sized to meet CFL criteria of HW/D =1.2. The results are shown in Table 7.

Pipe Type	Dimensions (span x rise)	Outlet Velocity (ft/s)	HW/D	Allowable?
Structural Steel Plate Pipe Arch	141.8" 91.3"	35	1.20	Yes
CBC	10' x 8'	55	1.18	Yes
CMP	9'	45	1.20	Yes
CMP	8'	45	1.75, overtops the road at 898 cfs	No
Snap Tite Liner*	6.5' Inner Diameter	55	Overtops road at 615 cfs	No
Generic Slip Liner	7.5 '	54	Overtops the road at 799 cfs	No
Generic Slip Liner with 2.5' overflow pipe	7.5 '	54	1.7	No

* Inner Diameter from Snap Tite Product Specification Table – Appendix C

Table 8 Burr Creek Culvert Options

The first three options would conform to the CFL standard so the deciding factors may be cost and constructability.

SUMMARY

Floodplain/Roadway

The 100-yr flood event discharge is 23800 cfs. The existing HEC-RAS model shows that the road is inundated in the area of concern (approximately 1900 feet downstream of the bridge) by approximately 2 feet of water between river stations 1703 and 1325. The proposed HEC RAS model that is based on the proposed road realignment shows no overtopping of the road and only a slight water surface elevation increase of 0.09 ft at river station 2491.

Culverts

The 30 proposed cross drainage culverts were sized for the 100-year flood event and conform to the CFL HW/D ratio =<1.5 for culverts <48".

Update – December 2014

In the summer of 2014 a decision was made to remove the Burr Creek 8 ft diameter CMP pipe and replace it with a 10 ft diameter CMP pipe with structural steel plate welded to the bottom of the pipe. This decision was made in cooperation with senior CALTRANS hydraulic engineers in Sacramento. The steel plate will protect the bottom of the pipe from the large rocks and heavy debris load that must pass through the pipe due to the debris generated by the slide upstream. The Burr Creek culvert conforms to the HW/D ratio of 1.2 for culverts >48" with a HW/D = 1.07.

REFERENCES

Aquaveo (2012) Watershed Modeling System 9.1 (www.aquaveo.com)

FHWA (2007) "Project Development and Design Manual for Central Federal Lands Highway Division"
Chp. 7. Federal Highway Administration (FHWA)

FHWA (2012) HY-8 Culvert Analysis Program version 7.3

FHWA Hydraulic Toolbox (2013) version 4.2

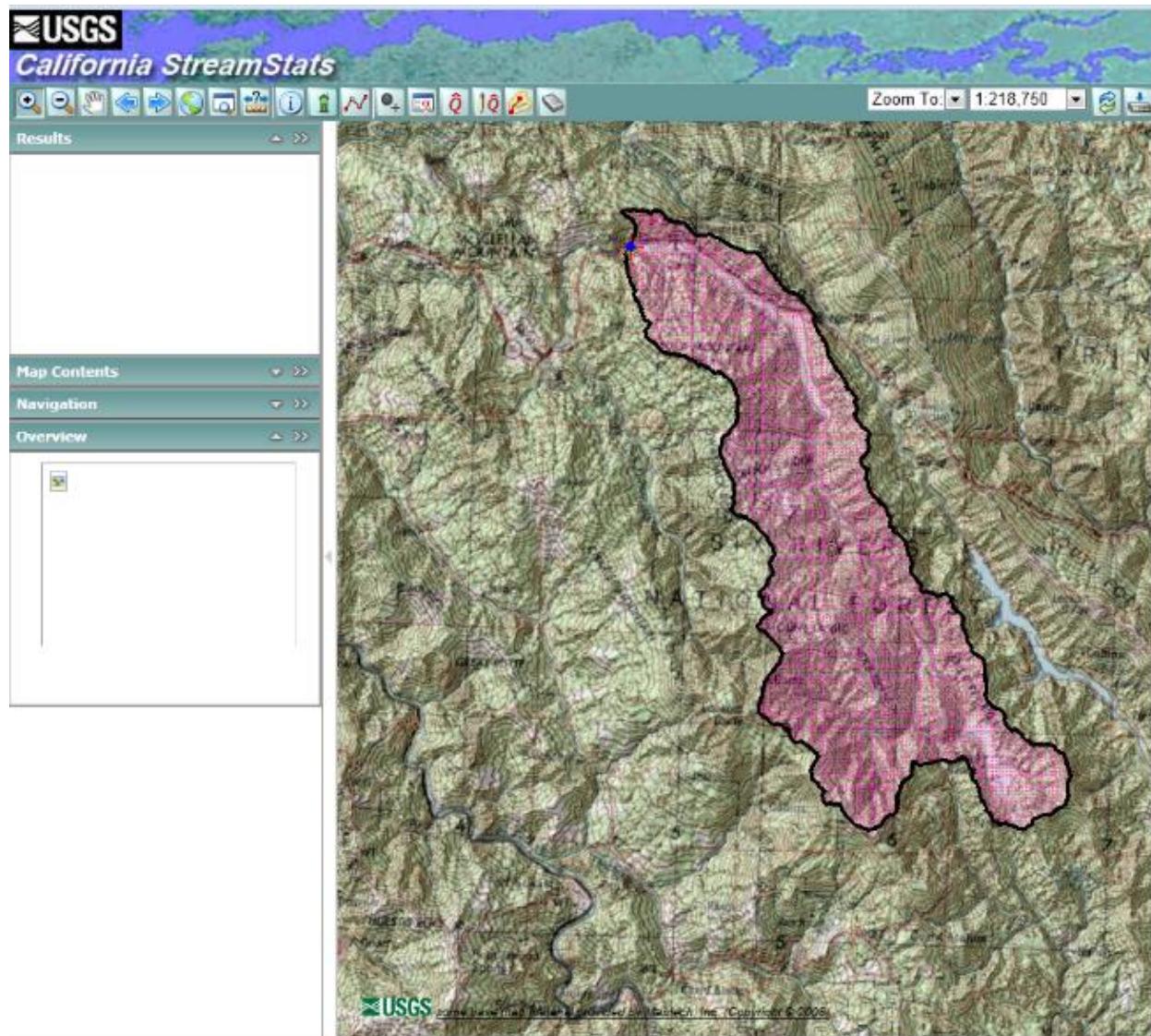
Hydrologic Engineering Center River Analysis System (HEC-RAS) Software", USACE (2010) "US Army
Corps of Engineers HydVersion 4.1 build date 2010

National Oceanic Atmospheric Administration (NOAA) Hydrometeorological Design Studies Center,
Precipitation Frequency Data Server, NOAA Atlas 14, California

USGS Stream Stats California application accessed September 2012 at
<http://water.usgs.gov/osw/streamstats/california.html>

APPENDIX A

HYDROLOGY



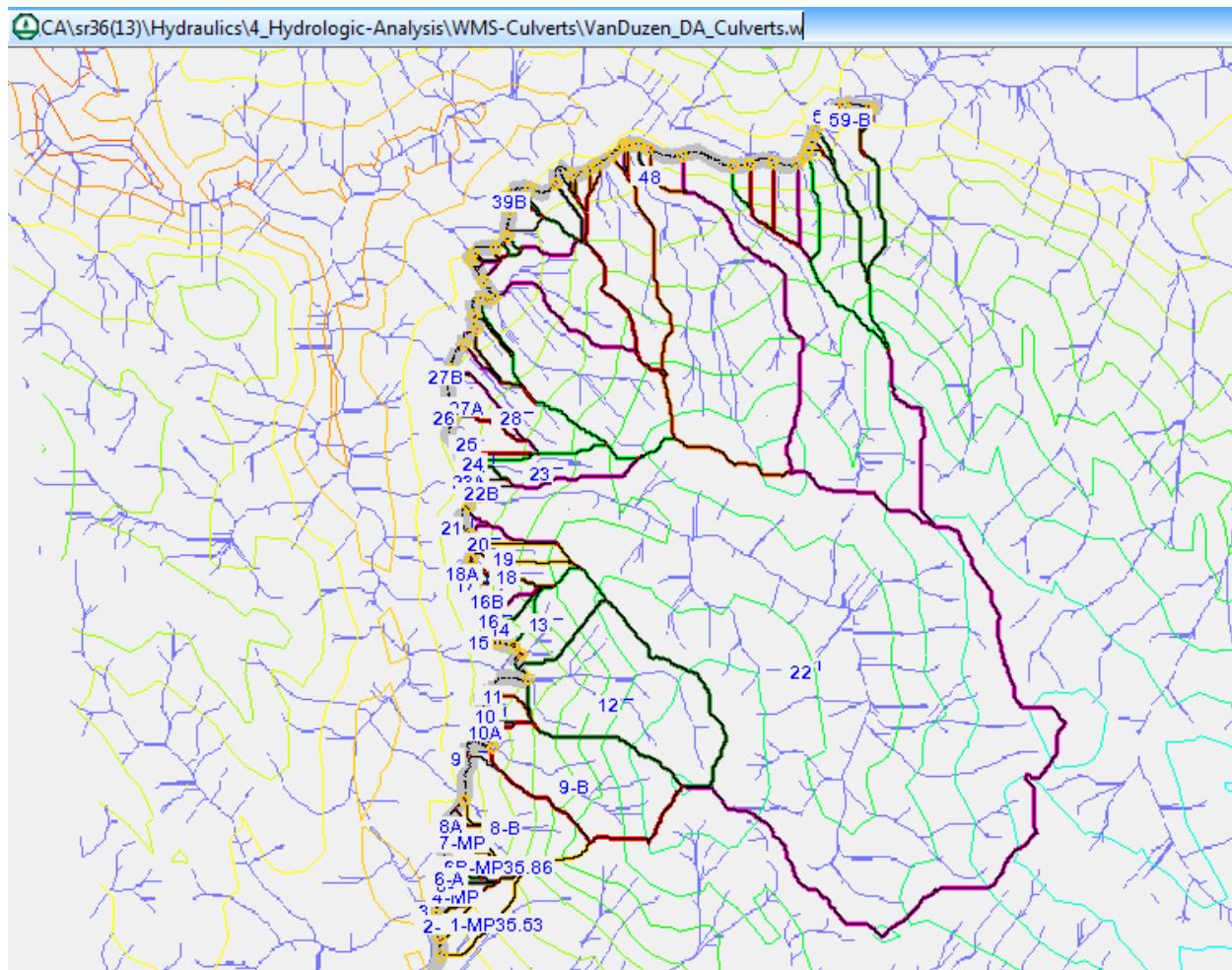
StreamStats Drainage Area of Van Duzen Bridge on north side of project.

Table 5. Regional flood-frequency equations for rural ungaged streams in California.

[mi², square miles; DRNAREA, drainage area, in mi²; PRECIP, mean annual precipitation, in inches; ELEV, mean basin elevation, in feet]

		Percent annual exceedance probability	Hydrologic region (shown in pl. 1)		
			North Coast (Region 1)	Lahontan (Region 2)	Sierra Nevada (Region 3)
2-yr	6638	50	$1.82(DRNAREA)^{0.904}(PRECIP)^{0.983}$	$0.0865(DRNAREA)^{0.730}(PRECIP)^{1.59}$	$2.43(DRNAREA)^{0.924}(ELEV)^{-0.646}(PRECIP)^{2.06}$
5-yr	11063	20	$8.11(DRNAREA)^{0.887}(PRECIP)^{0.772}$	$0.182(DRNAREA)^{0.731}(PRECIP)^{1.58}$	$11.6(DRNAREA)^{0.907}(ELEV)^{-0.566}(PRECIP)^{1.70}$
10-yr	14114	10	$14.8(DRNAREA)^{0.880}(PRECIP)^{0.696}$	$0.260(DRNAREA)^{0.734}(PRECIP)^{1.59}$	$17.2(DRNAREA)^{0.896}(ELEV)^{-0.486}(PRECIP)^{1.54}$
25-yr	18019	4	$26.0(DRNAREA)^{0.874}(PRECIP)^{0.628}$	$0.394(DRNAREA)^{0.733}(PRECIP)^{1.58}$	$20.7(DRNAREA)^{0.885}(ELEV)^{-0.386}(PRECIP)^{1.39}$
50-yr	20897	2	$36.3(DRNAREA)^{0.870}(PRECIP)^{0.589}$	$0.532(DRNAREA)^{0.731}(PRECIP)^{1.58}$	$21.1(DRNAREA)^{0.879}(ELEV)^{-0.316}(PRECIP)^{1.31}$
100-yr	23800	1	$48.5(DRNAREA)^{0.866}(PRECIP)^{0.556}$	$0.713(DRNAREA)^{0.731}(PRECIP)^{1.56}$	$20.6(DRNAREA)^{0.874}(ELEV)^{-0.250}(PRECIP)^{1.24}$
500-yr	26527	0.5	$61.0(DRNAREA)^{0.863}(PRECIP)^{0.531}$	$0.944(DRNAREA)^{0.729}(PRECIP)^{1.55}$	$19.4(DRNAREA)^{0.870}(ELEV)^{-0.188}(PRECIP)^{1.18}$
		0.2	$79.3(DRNAREA)^{0.860}(PRECIP)^{0.503}$	$1.35(DRNAREA)^{0.727}(PRECIP)^{1.52}$	$17.4(DRNAREA)^{0.865}(ELEV)^{-0.110}(PRECIP)^{1.11}$

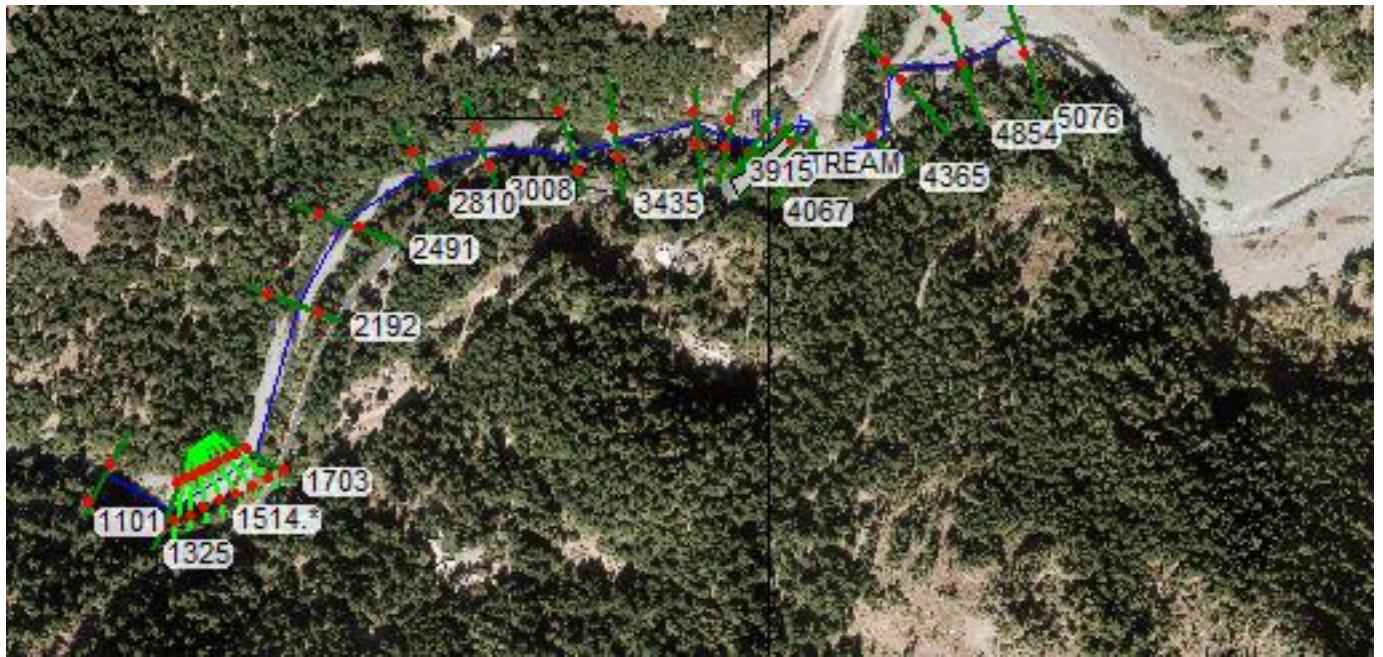
Discharge Results from USGS North Coast (Region 1) Equations



WMS graphic of culvert drainage areas

APPENDIX B

BRIDGE HYDRAULICS



Location of HEC RAS Bridge Cross Sections

Existing Conditions HEC RAS MODEL

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
STREAM	5076	2-yr	6640	2352.97	2362.25	2358.57	2362.39	0.000498	3.4	2956.3	567.18	0.23
STREAM	5076	50-yr	20900	2352.97	2371.89	2361.21	2372.05	0.000193	3.81	8791.45	643.1	0.17
STREAM	5076	100-yr	23800	2352.97	2373.53	2361.62	2373.69	0.000178	3.9	9856.66	656.02	0.16
STREAM	4854	2-yr	6640	2352.59	2362.05	2357.77	2362.26	0.000613	4.2	2343.93	367.69	0.26
STREAM	4854	50-yr	20900	2352.59	2371.65	2361.08	2371.97	0.000355	5.41	6082.42	412.69	0.23
STREAM	4854	100-yr	23800	2352.59	2373.28	2361.73	2373.62	0.000337	5.58	6761.23	420.76	0.22
STREAM	4635	2-yr	6640	2348.13	2358.74	2358.74	2361.65	0.009256	13.85	522.72	98.68	0.96
STREAM	4635	50-yr	20900	2348.13	2366.19	2365.48	2371.29	0.006235	18.89	1370.91	133.41	0.89
STREAM	4635	100-yr	23800	2348.13	2367.79	2366.56	2372.95	0.005499	19.08	1599.46	152.18	0.86
STREAM	4365	2-yr	6640	2346.84	2357.86	2354.61	2358.7	0.002015	7.48	969.71	132.58	0.47
STREAM	4365	50-yr	20900	2346.84	2367.28	2360.18	2368.87	0.001378	10.45	2341.76	160.95	0.44
STREAM	4365	100-yr	23800	2346.84	2368.9	2361.09	2370.6	0.001313	10.83	2597.7	165.85	0.44
STREAM	4067	2-yr	6640	2345.93	2356.76	2354.21	2357.97	0.002765	8.9	794.18	113.71	0.55
STREAM	4067	50-yr	20900	2345.93	2365.88	2360.47	2368.21	0.002036	12.6	1899.99	150.96	0.53

STREAM	4067	100-yr	23800	2345.93	2367.44	2361.44	2369.94	0.001959	13.09	2093.56	157.62	0.53
STREAM	4013	2-yr	6640	2343.77	2356.83	2352.61	2357.62	0.00262	7.16	955.75	122.69	0.42
STREAM	4013	50-yr	20900	2343.77	2366.16	2358.9	2367.71	0.002113	10.34	2296.36	184.29	0.43
STREAM	4013	100-yr	23800	2343.77	2367.77	2359.89	2369.41	0.002015	10.68	2687.64	190.6	0.42
STREAM	4000		Bridge									
STREAM	3965	2-yr	6640	2343.14	2355.98	2353.02	2357.26	0.006584	9.09	730.99	96.3	0.58
STREAM	3965	50-yr	20900	2343.14	2364.65	2359.9	2367.24	0.004962	13.03	1665.13	135.24	0.57
STREAM	3965	100-yr	23800	2343.14	2366.09	2360.92	2368.89	0.004811	13.58	1823.25	140.85	0.57
STREAM	3915	2-yr	6640	2342.49	2355.16	2353.06	2356.83	0.006846	10.39	640.56	84.14	0.65
STREAM	3915	50-yr	20900	2342.49	2361.96	2360.1	2366.4	0.008216	17.01	1273.45	107.56	0.79
STREAM	3915	100-yr	23800	2342.49	2362.97	2361.23	2367.95	0.008461	18.06	1369.59	110.88	0.81
STREAM	3816	2-yr	6640	2342.54	2354.54		2356.12	0.006625	10.08	658.55	85.37	0.64
STREAM	3816	50-yr	20900	2342.54	2361.28		2365.47	0.008131	16.44	1299.51	105.98	0.78
STREAM	3816	100-yr	23800	2342.54	2362.29	2360.26	2366.98	0.008317	17.42	1408.46	110.35	0.8
STREAM	3697	2-yr	6640	2342.92	2354.38		2355.32	0.003111	7.8	862.93	103.65	0.46
STREAM	3697	50-yr	20900	2342.92	2361.34		2364.14	0.004357	13.56	1648.79	122.12	0.6
STREAM	3697	100-yr	23800	2342.92	2362.4		2365.55	0.004525	14.43	1779.7	124.95	0.62
STREAM	3435	2-yr	6640	2341.22	2352.94		2354.23	0.00571	9.24	760.78	119.3	0.6
STREAM	3435	50-yr	20900	2341.22	2359.95		2362.88	0.005593	14.21	1697.01	147.48	0.66
STREAM	3435	100-yr	23800	2341.22	2361.11		2364.29	0.005509	14.85	1871.93	152.11	0.66
STREAM	3292	2-yr	6640	2339.7	2352.43		2353.3	0.005687	7.51	884.33	159.87	0.56
STREAM	3292	50-yr	20900	2339.7	2360.57		2361.81	0.002945	8.94	2351.03	198.34	0.45
STREAM	3292	100-yr	23800	2339.7	2361.89		2363.2	0.002747	9.19	2616.25	203.93	0.44
STREAM	3008	2-yr	6640	2338.58	2351.75		2352.55	0.003359	7.22	931.43	133.17	0.46
STREAM	3008	50-yr	20900	2338.58	2359.43		2361.25	0.003025	10.96	2049.45	157.94	0.5
STREAM	3008	100-yr	23800	2338.58	2360.64		2362.64	0.003008	11.5	2243.78	161.86	0.5
STREAM	2810	2-yr	6640	2340.52	2351.25		2352.02	0.002266	7.02	948.6	118.86	0.43
STREAM	2810	50-yr	20900	2340.52	2358.78		2360.71	0.002496	11.2	1940.64	142.85	0.5
STREAM	2810	100-yr	23800	2340.52	2359.95		2362.1	0.002519	11.82	2109.94	145.79	0.51
STREAM	2491	2-yr	6640	2340.04	2350.58		2351.38	0.002314	7.25	987.42	148.45	0.44

STREAM	2491	50-yr	20900	2340.04	2358.19		2360.01	0.002315	11.21	2211.28	172.92	0.5
STREAM	2491	100-yr	23800	2340.04	2359.39		2361.38	0.002325	11.79	2419.84	176.76	0.5
STREAM	2192	2-yr	6640	2339.08	2349.83		2350.66	0.002498	7.36	928.12	127.83	0.46
STREAM	2192	50-yr	20900	2339.08	2357.18		2359.25	0.002655	11.73	1969.66	155.47	0.53
STREAM	2192	100-yr	23800	2339.08	2358.32		2360.61	0.002686	12.37	2149.16	159.75	0.54
STREAM	1703	2-yr	6640	2338.59	2348.69		2349.52	0.002256	7.37	966.59	130.16	0.44
STREAM	1703	50-yr	20900	2338.59	2355.59		2357.87	0.002972	12.47	1926.83	149.33	0.56
STREAM	1703	100-yr	23800	2338.59	2356.62		2359.2	0.003087	13.27	2083.05	153.43	0.57
STREAM	1655.75*	2-yr	6640	2338.26	2348.5		2349.39	0.002684	7.62	905.5	125.74	0.47
STREAM	1655.75*	50-yr	20900	2338.26	2355.41		2357.73	0.00315	12.47	1880.45	152.99	0.57
STREAM	1655.75*	100-yr	23800	2338.26	2356.46		2359.05	0.00323	13.21	2042.81	157.07	0.58
STREAM	1608.5*	2-yr	6640	2337.93	2348.27		2349.25	0.003205	7.96	855.53	123.12	0.51
STREAM	1608.5*	50-yr	20900	2337.93	2355.16		2357.56	0.003475	12.63	1802.59	154.65	0.59
STREAM	1608.5*	100-yr	23800	2337.93	2356.22		2358.88	0.003512	13.32	1968.41	158.36	0.6
STREAM	1561.25*	2-yr	6640	2337.6	2348		2349.07	0.003686	8.33	810.43	119.71	0.54
STREAM	1561.25*	50-yr	20900	2337.6	2354.88		2357.38	0.003894	12.82	1730.68	146.26	0.62
STREAM	1561.25*	100-yr	23800	2337.6	2355.94		2358.7	0.003898	13.49	1887.21	151.11	0.63
STREAM	1514.*	2-yr	6640	2337.27	2347.71		2348.88	0.004191	8.68	771.95	115.53	0.58
STREAM	1514.*	50-yr	20900	2337.27	2354.53		2357.17	0.004496	13.16	1665.67	144.55	0.65
STREAM	1514.*	100-yr	23800	2337.27	2355.6		2358.49	0.004442	13.76	1823.85	148.37	0.66
STREAM	1466.75*	2-yr	6640	2336.93	2347.4		2348.66	0.004706	9.01	740.04	112.13	0.61
STREAM	1466.75*	50-yr	20900	2336.93	2354.07		2356.93	0.005017	13.65	1593.44	141.66	0.69
STREAM	1466.75*	100-yr	23800	2336.93	2355.14		2358.25	0.005008	14.24	1747.67	145.76	0.69
STREAM	1419.5*	2-yr	6640	2336.6	2347.05		2348.41	0.005377	9.37	709.51	110.23	0.64
STREAM	1419.5*	50-yr	20900	2336.6	2353.56		2356.65	0.005641	14.18	1521.74	138.62	0.73
STREAM	1419.5*	100-yr	23800	2336.6	2354.61		2357.97	0.005609	14.78	1670.46	142.67	0.73
STREAM	1372.25*	2-yr	6640	2336.27	2346.59	2345.1	2348.12	0.006498	9.91	670.34	108.71	0.7
STREAM	1372.25*	50-yr	20900	2336.27	2352.94	2351.01	2356.33	0.006475	14.82	1443.88	134.99	0.77
STREAM	1372.25*	100-yr	23800	2336.27	2353.98	2351.97	2357.65	0.006421	15.44	1586.1	139.18	0.78
STREAM	1325	2-yr	6640	2335.94	2344.97	2344.97	2347.57	0.014208	12.96	512.52	99.32	1.01
STREAM	1325	50-yr	20900	2335.94	2350.89	2350.89	2355.78	0.011371	17.78	1189.26	126.3	1

STREAM	1325	100-yr	23800	2335.94	2351.8	2351.8	2357.1	0.011181	18.5	1306.32	129.82	1
STREAM	1101	2-yr	6640	2333.67	2343.53	2342.02	2344.93	0.006001	9.47	703.88	118.41	0.68
STREAM	1101	50-yr	20900	2333.67	2349.58	2347.6	2352.84	0.006002	14.53	1486.58	139.67	0.75
STREAM	1101	100-yr	23800	2333.67	2350.52	2348.45	2354.11	0.006001	15.3	1618.04	142.41	0.76

PROPOSED Conditions HEC RAS MODEL

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
STREAM	5076	2-yr	6640	2352.97	2362.25	2358.57	2362.39	0.000498	3.4	2956.3	567.18	0.23
STREAM	5076	50-yr	20900	2352.97	2371.89	2361.21	2372.05	0.000193	3.81	8791.45	643.1	0.17
STREAM	5076	100-yr	23800	2352.97	2373.53	2361.62	2373.69	0.000178	3.9	9856.81	656.02	0.16
STREAM	4854	2-yr	6640	2352.59	2362.05	2357.77	2362.26	0.000613	4.2	2343.93	367.69	0.26
STREAM	4854	50-yr	20900	2352.59	2371.65	2361.08	2371.97	0.000355	5.41	6082.42	412.69	0.23
STREAM	4854	100-yr	23800	2352.59	2373.28	2361.73	2373.62	0.000337	5.58	6761.33	420.77	0.22
STREAM	4635	2-yr	6640	2348.13	2358.74	2358.74	2361.65	0.009256	13.85	522.72	98.68	0.96
STREAM	4635	50-yr	20900	2348.13	2366.19	2365.48	2371.29	0.006234	18.89	1370.94	133.41	0.89
STREAM	4635	100-yr	23800	2348.13	2367.79	2366.56	2372.95	0.005498	19.08	1599.64	152.18	0.86
STREAM	4365	2-yr	6640	2346.84	2357.86	2354.61	2358.7	0.002015	7.48	969.71	132.58	0.47
STREAM	4365	50-yr	20900	2346.84	2367.28	2360.18	2368.87	0.001378	10.45	2341.84	160.96	0.44
STREAM	4365	100-yr	23800	2346.84	2368.9	2361.09	2370.6	0.001313	10.83	2597.86	165.85	0.44
STREAM	4067	2-yr	6640	2345.93	2356.76	2354.21	2357.97	0.002765	8.9	794.18	113.71	0.55
STREAM	4067	50-yr	20900	2345.93	2365.88	2360.47	2368.21	0.002036	12.6	1900.05	150.97	0.53
STREAM	4067	100-yr	23800	2345.93	2367.44	2361.44	2369.94	0.001958	13.09	2093.69	157.62	0.53
STREAM	4013	2-yr	6640	2343.77	2356.83	2352.61	2357.62	0.00262	7.16	955.75	122.69	0.42
STREAM	4013	50-yr	20900	2343.77	2366.16	2358.9	2367.71	0.002113	10.34	2296.47	184.29	0.43
STREAM	4013	100-yr	23800	2343.77	2367.77	2359.89	2369.41	0.002015	10.68	2687.83	190.6	0.42
STREAM	4000		Bridge									
STREAM	3965	2-yr	6640	2343.14	2355.98	2353.02	2357.26	0.006584	9.09	730.99	96.3	0.58
STREAM	3965	50-yr	20900	2343.14	2364.65	2359.9	2367.24	0.004961	13.03	1665.21	135.24	0.57
STREAM	3965	100-yr	23800	2343.14	2366.09	2360.92	2368.89	0.00481	13.57	1823.36	140.85	0.57

STREAM	3915	2-yr	6640	2342.49	2355.16	2353.06	2356.83	0.006846	10.39	640.56	84.14	0.65	
STREAM	3915	50-yr	20900	2342.49	2361.97	2360.1	2366.4	0.008211	17.01	1273.69	107.57	0.79	
STREAM	3915	100-yr	23800	2342.49	2362.97	2361.23	2367.96	0.008448	18.05	1370.25	110.9	0.81	
STREAM	3816	2-yr	6640	2342.54	2354.54		2356.12	0.006625	10.08	658.55	85.37	0.64	
STREAM	3816	50-yr	20900	2342.54	2361.29		2365.47	0.008125	16.44	1299.87	106	0.78	
STREAM	3816	100-yr	23800	2342.54	2362.3	2360.26	2366.98	0.0083	17.41	1409.46	110.38	0.79	
STREAM	3697	2-yr	6640	2342.92	2354.38		2355.32	0.003111	7.8	862.93	103.65	0.46	
STREAM	3697	50-yr	20900	2342.92	2361.34		2364.14	0.004354	13.56	1649.27	122.13	0.6	
STREAM	3697	100-yr	23800	2342.92	2362.41		2365.56	0.004517	14.42	1780.86	124.98	0.62	
STREAM	3435	2-yr	6640	2341.22	2352.94		2354.23	0.00571	9.24	760.78	119.3	0.6	
STREAM	3435	50-yr	20900	2341.22	2359.95		2362.88	0.005583	14.21	1698.09	147.51	0.66	
STREAM	3435	100-yr	23800	2341.22	2361.13		2364.3	0.005486	14.84	1874.72	152.18	0.66	
STREAM	3292	2-yr	6640	2339.7	2352.43		2353.3	0.005687	7.51	884.33	159.87	0.56	
STREAM	3292	50-yr	20900	2339.7	2360.58		2361.82	0.00294	8.94	2352.43	198.37	0.45	
STREAM	3292	100-yr	23800	2339.7	2361.91		2363.21	0.002736	9.18	2619.63	204	0.44	
STREAM	3008	2-yr	6640	2338.58	2351.75		2352.55	0.003359	7.22	931.43	133.17	0.46	
STREAM	3008	50-yr	20900	2338.58	2359.44		2361.25	0.003019	10.95	2050.8	157.97	0.5	
STREAM	3008	100-yr	23800	2338.58	2360.66		2362.65	0.002995	11.49	2247.18	161.93	0.5	
STREAM	2810	2-yr	6640	2340.52	2351.25		2352.02	0.002266	7.02	948.6	118.86	0.43	
STREAM	2810	50-yr	20900	2340.52	2358.79		2360.72	0.00249	11.2	1942.07	142.88	0.5	
STREAM	2810	100-yr	23800	2340.52	2359.97		2362.11	0.002506	11.8	2113.57	145.85	0.51	
STREAM	2491	2-yr	6640	2340.04	2350.58		2351.38	0.002314	7.25	987.42	148.45	0.44	
STREAM	2491	50-yr	20900	2340.04	2358.21		2360.02	0.002309	11.2	2213.39	172.96	0.49	
STREAM	2491	100-yr	23800	2340.04	2359.42		2361.4	0.002311	11.77	2425.02	176.85	0.5	
STREAM	2192	2-yr	6640	2339.08	2349.83		2350.66	0.002498	7.36	928.12	127.83	0.46	
STREAM	2192	50-yr	20900	2339.08	2357.2		2359.26	0.002645	11.71	1972.2	155.53	0.53	
STREAM	2192	100-yr	23800	2339.08	2358.36		2360.64	0.002664	12.34	2155.4	159.9	0.54	
STREAM	1703	2-yr	6640	2338.59	2348.69		2349.52	0.002256	7.37	966.59	130.16	0.44	
STREAM	1703	50-yr	20900	2338.59	2355.61		2357.89	0.002954	12.45	1930.87	149.43	0.56	
STREAM	1703	100-yr	23800	2338.59	2356.69		2359.24	0.003045	13.21	2093.06	153.68	0.57	

STREAM	1655.75*	2-yr	6640	2338.26	2348.5		2349.39	0.002684	7.62	905.5	125.74	0.47
STREAM	1655.75*	50-yr	20900	2338.26	2355.44		2357.75	0.003128	12.45	1885.01	153.09	0.57
STREAM	1655.75*	100-yr	23800	2338.26	2356.53		2359.09	0.003181	13.15	2053.78	157.36	0.58
STREAM	1608.5*	2-yr	6640	2337.93	2348.27		2349.25	0.003205	7.96	855.53	123.12	0.51
STREAM	1608.5*	50-yr	20900	2337.93	2355.19		2357.58	0.003447	12.6	1807.72	154.77	0.59
STREAM	1608.5*	100-yr	23800	2337.93	2356.29		2358.93	0.00345	13.24	1980.8	158.63	0.6
STREAM	1561.25*	2-yr	6640	2337.6	2348		2349.07	0.003686	8.33	810.43	119.71	0.54
STREAM	1561.25*	50-yr	20900	2337.6	2354.92		2357.4	0.003858	12.78	1736.08	146.38	0.62
STREAM	1561.25*	100-yr	23800	2337.6	2356.02		2358.75	0.003819	13.41	1900.45	151.69	0.62
STREAM	1514.*	2-yr	6640	2337.27	2347.71		2348.88	0.004191	8.68	771.95	115.53	0.58
STREAM	1514.*	50-yr	20900	2337.27	2354.25		2357.16	0.004436	13.85	1626.05	143.5	0.66
STREAM	1514.*	100-yr	23800	2337.27	2355.28		2358.5	0.004465	14.59	1776.36	147.29	0.67
STREAM	1466.75*	2-yr	6640	2336.93	2347.4		2348.66	0.004706	9.01	740.04	112.13	0.61
STREAM	1466.75*	50-yr	20900	2336.93	2354.07		2356.93	0.005017	13.65	1593.44	141.66	0.69
STREAM	1466.75*	100-yr	23800	2336.93	2355.14		2358.25	0.005008	14.24	1747.67	145.76	0.69
STREAM	1419.5*	2-yr	6640	2336.6	2347.05		2348.41	0.005377	9.37	709.51	110.23	0.64
STREAM	1419.5*	50-yr	20900	2336.6	2353.56		2356.65	0.005641	14.18	1521.74	138.62	0.73
STREAM	1419.5*	100-yr	23800	2336.6	2354.61		2357.97	0.005609	14.78	1670.46	142.67	0.73
STREAM	1372.25*	2-yr	6640	2336.27	2346.59	2345.1	2348.12	0.006498	9.91	670.34	108.71	0.7
STREAM	1372.25*	50-yr	20900	2336.27	2352.94	2351.01	2356.33	0.006475	14.82	1443.88	134.99	0.77
STREAM	1372.25*	100-yr	23800	2336.27	2353.98	2351.97	2357.65	0.006421	15.44	1586.1	139.18	0.78
STREAM	1325	2-yr	6640	2335.94	2344.97	2344.97	2347.57	0.014208	12.96	512.52	99.32	1.01
STREAM	1325	50-yr	20900	2335.94	2350.89	2350.89	2355.78	0.011371	17.78	1189.26	126.3	1
STREAM	1325	100-yr	23800	2335.94	2351.8	2351.8	2357.1	0.011181	18.5	1306.32	129.82	1
STREAM	1101	2-yr	6640	2333.67	2343.53	2342.02	2344.93	0.006001	9.47	703.88	118.41	0.68
STREAM	1101	50-yr	20900	2333.67	2349.58	2347.6	2352.84	0.006002	14.53	1486.58	139.67	0.75
STREAM	1101	100-yr	23800	2333.67	2350.52	2348.45	2354.11	0.006001	15.3	1618.04	142.41	0.76

APPENDIX C

Culvert Hydraulics

Using HY 8

Station 1905+31

Crossing Data - station 1905+31

Crossing Properties			Culvert Properties		
Name: station 1905+31					
Parameter	Value	Units	Parameter	Value	Units
DISCHARGE DATA			Culvert 1		
Minimum Flow	0.00	cfs	Add Culvert		
Design Flow	11.00	cfs	Duplicate Culvert		
Maximum Flow	15.00	cfs	Delete Culvert		
TAILWATER DATA					
Channel Type	Trapezoidal Channel				
Bottom Width	2.00	ft			
Side Slope (H:V)	2.00	_:1			
Channel Slope	0.0200	ft/ft			
Manning's n (channel)	0.0500				
Channel Invert Elevation	2580.00	ft			
Rating Curve	View...				
ROADWAY DATA					
Roadway Profile Shape	Constant Roadway Elevation				
First Roadway Station	0.00	ft			
Crest Length	100.00	ft			
Crest Elevation	2584.00	ft			
Roadway Surface	Paved				
Top Width	32.00	ft			

Help Click on any icon for help on a specific topic

Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	2581.50	0.00	0.0	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
1.50	1.50	2582.03	0.53	0.0*	1-S2n	0.35	0.38	0.35	0.33	4.17	1.69
3.00	3.00	2582.27	0.77	0.0*	1-S2n	0.48	0.54	0.48	0.49	3.95	2.07
4.50	4.50	2582.45	0.95	0.0*	1-S2n	0.61	0.66	0.61	0.60	4.34	2.33
6.00	6.00	2582.60	1.10	0.0*	1-S2n	0.70	0.77	0.70	0.70	4.74	2.52
7.50	7.50	2582.75	1.25	0.0*	1-S2n	0.79	0.86	0.79	0.78	5.04	2.68
9.00	9.00	2582.88	1.38	0.0*	1-S2n	0.87	0.95	0.87	0.86	5.27	2.81
10.50	10.50	2582.99	1.49	0.0*	1-S2n	0.94	1.03	0.94	0.93	5.54	2.93
11.00	11.00	2583.03	1.53	0.0*	1-S2n	0.97	1.05	0.97	0.95	5.58	2.97
13.50	13.50	2583.22	1.72	0.0*	1-S2n	1.07	1.17	1.07	1.05	5.91	3.13
15.00	15.00	2583.33	1.83	0.0*	1-S2n	1.14	1.23	1.14	1.11	6.07	3.22

Display

- Crossing Summary Table
- Culvert Summary Table Culvert 1
- Water Surface Profiles
- Tapered Inlet Table
- Customized Table Options...

Geometry

Inlet Elevation: 2581.50 ft
 Outlet Elevation: 2580.00 ft
 Culvert Length: 50.02 ft
 Culvert Slope: 0.0300
 Inlet Crest: 0.00 ft
 Inlet Throat: 0.00 ft

Plot

Crossing Rating Curve
 Culvert Performance Curve
 Selected Water Profile
 Water Surface Profile Data

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 1917+31

Crossing Data - 1917+31

Crossing Properties		
Name:	1917+31	
Parameter	Value	Units
DISCHARGE DATA		
Minimum Flow	5.00	cfs
Design Flow	86.50	cfs
Maximum Flow	95.00	cfs
TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	8.00	ft
Side Slope (H:V)	2.00	
Channel Slope	0.0200	ft/ft
Manning's n (channel)	0.0500	
Channel Invert Elevation	2625.00	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.00	ft
Crest Length	100.00	ft
Crest Elevation	2660.00	ft
Roadway Surface	Paved	
Top Width	32.00	ft

Culvert Properties		
Culvert 1	Add Culvert	
CULVERT DATA		
Name	Culvert 1	
Shape	Circular	
Material	Corrugated Aluminum	
Diameter	4.00	ft
Embedment Depth	0.00	in
Manning's n	0.0310	
Culvert Type	Straight	
Inlet Configuration	Thin Edge Projecting	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	2636.00	ft
Outlet Station	71.00	ft
Outlet Elevation	2625.00	ft

Help Click on any icon for help on a specific topic Energy Dissipation Analyze Crossing OK Cancel

Summary of Flows at Crossing - 1917+31

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2636.82	5.00	5.00	0.00	1
2637.41	14.00	14.00	0.00	1
2637.84	23.00	23.00	0.00	1
2638.25	32.00	32.00	0.00	1
2638.66	41.00	41.00	0.00	1
2639.06	50.00	50.00	0.00	1
2639.47	59.00	59.00	0.00	1
2639.89	68.00	68.00	0.00	1
2640.34	77.00	77.00	0.00	1
2640.82	86.00	86.00	0.00	1
2640.85	86.50	86.50	0.00	1
2660.00	249.56	249.56	0.00	Overtopping

Display

Crossing Summary Table

Culvert Summary Table

Water Surface Profiles

Tapered Inlet Table

Customized Table

Geometry

Inlet Elevation: 2636.00 ft

Outlet Elevation: 2625.00 ft

Culvert Length: 71.85 ft

Culvert Slope: 0.1549

Inlet Crest: 0.00 ft

Inlet Throat: 0.00 ft

Plot

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 1932+00

Crossing Data - Sta 1932+00

Crossing Properties			Culvert Properties		
Name: Sta 1932+00			Culvert Properties		
Parameter	Value	Units	Parameter	Value	Units
<input checked="" type="checkbox"/> DISCHARGE DATA			<input checked="" type="checkbox"/> Culvert 1	Add Culvert	
Minimum Flow	10.00	cfs		Duplicate Culvert	
Design Flow	109.00	cfs		Delete Culvert	
Maximum Flow	150.00	cfs			
<input checked="" type="checkbox"/> TAILWATER DATA					
Channel Type	Trapezoidal Channel				
Bottom Width	7.00	ft			
Side Slope (H:V)	2.00				
Channel Slope	0.2000	ft/ft			
Manning's n (channel)	0.0500				
Channel Invert Elevation	2735.00	ft			
Rating Curve	View...				
<input checked="" type="checkbox"/> ROADWAY DATA					
Roadway Profile Shape	Constant Roadway Elevation				
First Roadway Station	0.00	ft			
Crest Length	100.00	ft			
Crest Elevation	2755.00	ft			
Roadway Surface	Paved				
Top Width	35.00	ft			

Help Click on any  icon for help on a specific topic

Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10.00	10.00	2739.19	1.19	0.0*	1-S2n	0.79	0.89	0.79	0.26	5.21	5.12
24.00	24.00	2739.89	1.89	0.0*	1-S2n	1.25	1.40	1.25	0.44	6.62	7.01
38.00	38.00	2740.42	2.42	0.0*	1-S2n	1.59	1.77	1.59	0.57	7.52	8.21
52.00	52.00	2740.92	2.92	0.0*	1-S2n	1.90	2.09	1.90	0.68	8.16	9.11
66.00	66.00	2741.38	3.38	0.16	1-S2n	2.17	2.37	2.17	0.78	8.67	9.85
80.00	80.00	2741.84	3.84	0.94	1-S2n	2.44	2.62	2.44	0.87	9.09	10.48
94.00	94.00	2742.29	4.29	1.79	1-S2n	2.70	2.85	2.70	0.96	9.42	11.03
108.00	108.00	2742.77	4.77	2.71	5-S2n	2.98	3.06	2.98	1.03	9.69	11.52
109.00	109.00	2742.80	4.80	2.98	5-S2n	3.00	3.07	3.00	1.04	9.71	11.55
136.00	136.00	2743.92	5.83	5.92	7-M2c	3.59	3.43	3.43	1.18	10.46	12.36
150.00	150.00	2744.43	6.43~	6.36	7-M2c	4.50	3.59	3.59	1.24	11.02	12.74

Display

- Crossing Summary Table
- Culvert Summary Table Culvert 1
- Water Surface Profiles
- Tapered Inlet Table
- Customized Table Options...

Geometry

Inlet Elevation: 2738.00 ft
 Outlet Elevation: 2735.00 ft
 Culvert Length: 105.04 ft
 Culvert Slope: 0.0286
 Inlet Crest: 0.00 ft
 Inlet Throat: 0.00 ft

Plot

Crossing Rating Curve
 Culvert Performance Curve
 Selected Water Profile
 Water Surface Profile Data

* Full Flow Headwater elevation is below inlet invert.
 ~ Inlet control is shown, but flow profile is substantially FF.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 1935+39

Crossing Data - Station 1935+39

Crossing Properties			Culvert Properties		
Name: Station 1935+39			Culvert 1		
Parameter	Value	Units			
<input checked="" type="radio"/> DISCHARGE DATA			Add Culvert		
Minimum Flow	1.00	cfs	Duplicate Culvert		
Design Flow	18.50	cfs	Delete Culvert		
Maximum Flow	60.00	cfs			
<input checked="" type="radio"/> TAILWATER DATA					
Channel Type	Trapezoidal Channel				
Bottom Width	2.00	ft			
Side Slope (H:V)	2.00	1:1			
Channel Slope	0.4580	ft/ft			
Manning's n (channel)	0.0300				
Channel Invert Elevation	2763.00	ft			
Rating Curve	View...				
<input checked="" type="radio"/> ROADWAY DATA					
Roadway Profile Shape	Constant Roadway Elevation				
First Roadway Station	0.00	ft			
Crest Length	100.00	ft			
Crest Elevation	2835.00	ft			
Roadway Surface	Paved				
Top Width	36.00	ft			

Help Click on any  icon for help on a specific topic

Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	2809.38	0.38	0.0*	1-S2n	0.14	0.32	0.14	0.08	4.95	5.84
6.90	6.90	2810.04	1.04	0.0*	1-S2n	0.46	0.87	0.46	0.24	10.85	11.34
12.80	12.80	2810.54	1.54	0.0*	1-S2n	0.63	1.20	0.63	0.35	13.00	13.75
18.50	18.50	2811.06	2.06	0.0*	1-S2n	0.77	1.46	0.77	0.42	14.34	15.34
24.60	24.60	2811.66	2.66	0.0*	5-S2n	0.90	1.69	0.90	0.49	15.51	16.67
30.50	30.50	2812.36	3.36	0.0*	5-S2n	1.01	1.88	1.01	0.55	16.37	17.72
36.40	36.40	2813.21	4.21	0.0*	5-S2n	1.11	2.05	1.11	0.61	17.18	18.63
42.30	42.30	2814.25	5.25	0.0*	5-S2n	1.22	2.18	1.22	0.66	17.82	19.42
48.20	48.20	2815.48	6.48	0.0*	5-S2n	1.32	2.27	1.32	0.70	18.41	20.13
54.10	54.10	2816.89	7.89	0.0*	5-S2n	1.41	2.45	1.41	0.75	18.92	20.78
60.00	60.00	2818.41	9.41	0.0*	5-S2n	1.51	2.50	1.51	0.79	19.34	21.37

Display Geometry Plot

Crossing Summary Table Inlet Elevation: 2809.00 ft
 Culvert Summary Table Outlet Elevation: 2763.00 ft
 Water Surface Profiles Culvert Length: 180.94 ft
 Tapered Inlet Table Culvert Slope: 0.2629
 Customized Table Inlet Crest: 0.00 ft
 Options... Inlet Throat: 0.00 ft

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 1956+22

Crossing Data - Station 1956+22

Crossing Properties			Culvert Properties		
Name: Station 1956+22			Culvert 1		
Parameter	Value	Units			
DISCHARGE DATA			Add Culvert		
Minimum Flow	0.00	cfs	Duplicate Culvert		
Design Flow	4.50	cfs	Delete Culvert		
Maximum Flow	10.00	cfs			
TAILWATER DATA					
Channel Type	Trapezoidal Channel				
Bottom Width	2.00	ft			
Side Slope (H:V)	2.00	-1			
Channel Slope	0.6200	ft/ft			
Manning's n (channel)	0.0500				
Channel Invert Elevation	2873.00	ft			
Rating Curve	View...				
ROADWAY DATA					
Roadway Profile Shape	Constant Roadway Elevation				
First Roadway Station	0.00	ft			
Crest Length	100.00	ft			
Crest Elevation	2906.00	ft			
Roadway Surface	Paved				
Top Width	36.00	ft			

Help Click on any icon for help on a specific topic

Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	2900.50	0.00	0.0	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1.00	2900.82	0.32	0.0*	1-S2n	0.11	0.34	0.11	0.10	7.52	4.64
2.00	2.00	2900.95	0.45	0.0*	1-S2n	0.21	0.49	0.21	0.15	12.25	5.92
3.00	3.00	2901.05	0.55	0.0*	1-S2n	0.24	0.60	0.24	0.19	19.29	6.78
4.00	4.00	2901.14	0.64	0.0*	1-S2n	0.28	0.70	0.28	0.22	14.46	7.46
4.50	4.50	2901.18	0.68	0.0*	1-S2n	0.30	0.75	0.33	0.24	12.92	7.74
6.00	6.00	2901.29	0.79	0.0*	1-S2n	0.35	0.87	0.35	0.28	15.89	8.49
7.00	7.00	2901.35	0.85	0.0*	1-S2n	0.39	0.94	0.39	0.30	16.35	8.90
8.00	8.00	2901.41	0.91	0.0*	1-S2n	0.41	1.01	0.41	0.33	17.14	9.28
9.00	9.00	2901.47	0.97	0.0*	1-S2n	0.44	1.07	0.47	0.35	15.83	9.62
10.00	10.00	2901.55	1.05	0.0*	1-S2n	0.46	1.13	0.46	0.37	18.30	9.93

Display

- Crossing Summary Table
- Culvert Summary Table Culvert 1
- Water Surface Profiles
- Tapered Inlet Table
- Customized Table Options...

Geometry

Inlet Elevation: 2900.50 ft
 Outlet Elevation: 2873.00 ft
 Culvert Length: 44.51 ft
 Culvert Slope: 0.7857
 Inlet Crest: 0.00 ft
 Inlet Throat: 0.00 ft

Plot

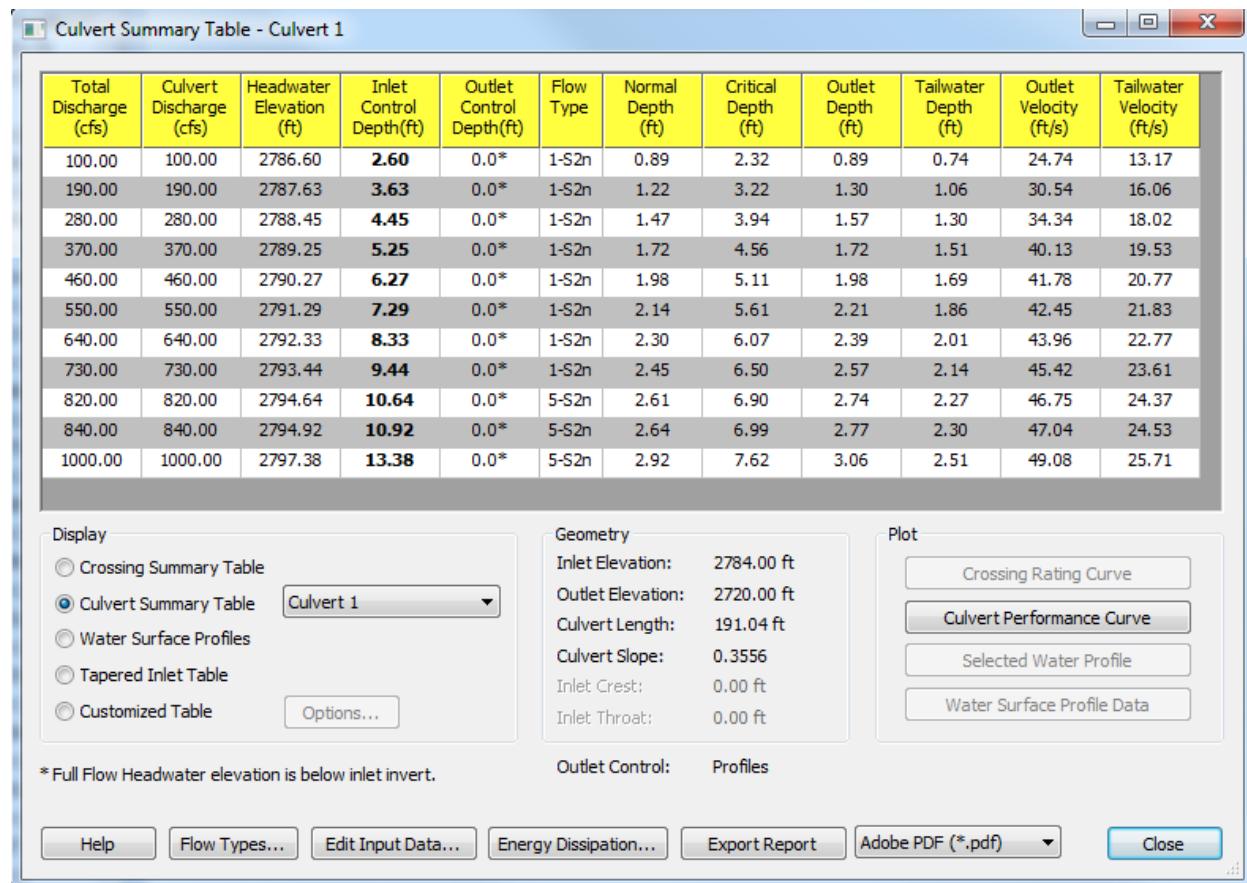
Crossing Rating Curve
 Culvert Performance Curve
 Selected Water Profile
 Water Surface Profile Data

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 1968+81 (Burr Creek)



Crossing Data - Burr Cr 120" pipe

Crossing Properties	Culvert Properties	
Name: Burr Cr 120" pipe	Culvert 1 Add Culvert Duplicate Culvert Delete Culvert	
Parameter	Value	Units
DISCHARGE DATA		
Minimum Flow	100.00	cfs
Design Flow	840.00	cfs
Maximum Flow	1000.00	cfs
TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	8.00	ft
Side Slope (H:V)	3.00	-:1
Channel Slope	0.3900	ft/ft
Manning's n (channel)	0.0500	
Channel Invert Elevation	2720.00	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.00	ft
Crest Length	100.00	ft
Crest Elevation	2799.00	ft
Roadway Surface	Paved	
Top Width	36.00	ft
Parameter	Value	Units
CULVERT DATA		
Name	Culvert 1	
Shape	Circular	
Material	Corrugated Steel	
Diameter	10.00	ft
Embedment Depth	0.00	in
Manning's n	0.0240	
Culvert Type	Straight	
Inlet Configuration	Thin Edge Projecting	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	2784.00	ft
Outlet Station	180.00	ft
Outlet Elevation	2720.00	ft

Help Click on any icon for help on a specific topic Energy Dissipation Analyze Crossing OK Cancel

Station 1974+89

Crossing Data - Station 1975+00

Crossing Properties		
Name:	Station 1974+89	
Parameter	Value	Units
DISCHARGE DATA		
Minimum Flow	0.00	cfs
Design Flow	9.40	cfs
Maximum Flow	15.00	cfs
TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	2.00	ft
Side Slope (H:V)	2.00	:1
Channel Slope	0.4900	ft/ft
Manning's n (channel)	0.0500	
Channel Invert Elevation	2690.60	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.00	ft
Crest Length	100.00	ft
Crest Elevation	2754.00	ft
Roadway Surface	Paved	
Top Width	36.00	ft

Culvert Properties		
Culvert 1	Add Culvert	
CULVERT DATA		
Name	Culvert 1	
Shape	Circular	
Material	Corrugated Aluminum	
Diameter	2.00	ft
Embedment Depth	0.00	in
Manning's n	0.0310	
Culvert Type	Straight	
Inlet Configuration	Thin Edge Projecting	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	2752.20	ft
Outlet Station	200.00	ft
Outlet Elevation	2690.60	ft

Help Click on any icon for help on a specific topic

Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	2752.20	0.00	0.0	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
1.50	1.50	2752.69	0.49	0.0*	1-S2n	0.22	0.42	0.22	0.13	9.29	4.96
3.00	3.00	2752.90	0.70	0.0*	1-S2n	0.31	0.60	0.31	0.20	9.47	6.27
4.50	4.50	2753.07	0.87	0.0*	1-S2n	0.39	0.75	0.39	0.25	10.28	7.15
6.00	6.00	2753.22	1.02	0.0*	1-S2n	0.45	0.87	0.45	0.30	11.63	7.82
7.50	7.50	2753.41	1.21	0.0*	1-S2n	0.50	0.97	0.50	0.34	12.07	8.38
9.00	9.00	2753.60	1.40	0.0*	1-S2n	0.55	1.07	0.55	0.37	12.64	8.86
9.40	9.40	2753.65	1.45	0.0*	1-S2n	0.57	1.09	0.57	0.38	12.77	8.97
12.00	12.00	2753.99	1.79	0.0*	1-S2n	0.64	1.24	0.64	0.43	13.79	9.65
13.50	12.27	2754.03	1.83	0.0*	1-S2n	0.65	1.26	0.65	0.46	13.76	9.98
15.00	12.39	2754.04	1.84	0.0*	1-S2n	0.66	1.27	0.66	0.49	13.80	10.29

Display		Geometry		Plot	
<input type="radio"/> Crossing Summary Table		Inlet Elevation:	2752.20 ft	<input type="button"/> Crossing Rating Curve	
<input checked="" type="radio"/> Culvert Summary Table	Culvert 1	Outlet Elevation:	2690.60 ft	<input type="button"/> Culvert Performance Curve	
<input type="radio"/> Water Surface Profiles		Culvert Length:	209.27 ft	<input type="button"/> Selected Water Profile	
<input type="radio"/> Tapered Inlet Table		Culvert Slope:	0.3080	<input type="button"/> Water Surface Profile Data	
<input type="radio"/> Customized Table	Options...	Inlet Crest:	0.00 ft		
		Inlet Throat:	0.00 ft		

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 1984+66

Crossing Data - Station 1984+66

Crossing Properties			Culvert Properties		
Name: Station 1984+66			<input type="button" value="Culvert 1"/> <input type="button" value="Add Culvert"/> <input type="button" value="Duplicate Culvert"/> <input type="button" value="Delete Culvert"/>		
Parameter	Value	Units	Parameter	Value	Units
DISCHARGE DATA			CULVERT DATA		
Minimum Flow	1.00	cfs	Name	Culvert 1	
Design Flow	30.00	cfs	Shape	Circular	
Maximum Flow	35.00	cfs	Material	Corrugated Aluminum	
TAILWATER DATA			Diameter	3.00	ft
Channel Type	Trapezoidal Channel		Embedment Depth	0.00	in
Bottom Width	4.00	ft	Manning's n	0.0310	
Side Slope (H:V)	2.00		Culvert Type	Straight	
Channel Slope	0.3400	ft/ft	Inlet Configuration	Thin Edge Projecting	
Manning's n (channel)	0.0550		Inlet Depression?	No	
Channel Invert Elevation	2708.00	ft	SITE DATA		
Rating Curve	View...		Site Data Input Option	Culvert Invert Data	
ROADWAY DATA			Inlet Station	0.00	ft
Roadway Profile Shape	Constant Roadway Elevation		Inlet Elevation	2710.00	ft
First Roadway Station	0.00	ft	Outlet Station	75.00	ft
Crest Length	100.00	ft	Outlet Elevation	2708.00	ft
Crest Elevation	2715.50	ft			
Roadway Surface	Paved				
Top Width	36.00	ft			

Click on any icon for help on a specific topic

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	2710.45	0.45	0.0*	1-S2n	0.30	0.31	0.30	0.08	2.72	2.90
4.40	4.40	2710.94	0.94	0.0*	1-S2n	0.62	0.66	0.62	0.20	4.16	5.01
7.80	7.80	2711.28	1.28	0.0*	1-S2n	0.83	0.88	0.83	0.28	4.87	6.13
11.20	11.20	2711.55	1.55	0.0*	1-S2n	1.00	1.06	1.00	0.34	5.38	6.93
14.60	14.60	2711.81	1.81	0.0*	1-S2n	1.16	1.22	1.16	0.40	5.77	7.57
18.00	18.00	2712.05	2.05	0.0*	1-S2n	1.30	1.36	1.30	0.45	6.10	8.10
21.40	21.40	2712.29	2.29	0.07	1-S2n	1.44	1.49	1.44	0.50	6.38	8.56
24.80	24.80	2712.52	2.52	0.44	1-S2n	1.57	1.61	1.57	0.54	6.61	8.97
28.20	28.20	2712.75	2.75	0.83	1-S2n	1.70	1.72	1.70	0.58	6.81	9.34
30.00	30.00	2712.88	2.88	1.11	1-S2n	1.77	1.77	1.77	0.60	6.91	9.52
35.00	35.00	2713.46	3.25	3.46	7-M2c	1.97	1.92	1.92	0.66	7.32	9.98

Display

Crossing Summary Table

Culvert Summary Table **Culvert 1**

Water Surface Profiles

Tapered Inlet Table

Customized Table

Geometry

Inlet Elevation: 2710.00 ft

Outlet Elevation: 2708.00 ft

Culvert Length: 75.03 ft

Culvert Slope: 0.0267

Inlet Crest: 0.00 ft

Inlet Throat: 0.00 ft

Plot

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Station 1999+06

Crossing Data - Station 1999+06

Crossing Properties			Culvert Properties			
Name:	Station 1999+06		Culvert 1		Add Culvert	
Parameter	Value	Units	Parameter	Value	Units	
<input checked="" type="checkbox"/> DISCHARGE DATA			<input checked="" type="checkbox"/> CULVERT DATA			
Minimum Flow	10.00	cfs	Name	Culvert 1		Add Culvert
Design Flow	60.00	cfs	Shape	Circular		Duplicate Culvert
Maximum Flow	80.00	cfs	Material	Corrugated Aluminum		Delete Culvert
<input checked="" type="checkbox"/> TAILWATER DATA			Diameter	3.50	ft	
Channel Type	Trapezoidal Channel		Embedment Depth	0.00	in	
Bottom Width	5.00	ft	Manning's n	0.0310		
Side Slope (H:V)	2.00		Culvert Type	Straight		
Channel Slope	0.1600	ft/ft	Inlet Configuration	Thin Edge Projecting		
Manning's n (channel)	0.0550		Inlet Depression?	No		
Channel Invert Elevation	2612.80	ft	SITE DATA			
Rating Curve	View...		Site Data Input Option	Culvert Invert Data		
<input checked="" type="checkbox"/> ROADWAY DATA			Inlet Station	0.00	ft	
Roadway Profile Shape	Constant Roadway Elevation		Inlet Elevation	2615.00	ft	
First Roadway Station	0.00	ft	Outlet Station	110.00	ft	
Crest Length	100.00	ft	Outlet Elevation	2598.00	ft	
Crest Elevation	2620.00	ft				
Roadway Surface	Paved					
Top Width	36.00	ft				

Help Click on any  icon for help on a specific topic

Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10.00	10.00	2616.24	1.24	0.0*	1-JS1f	0.56	0.96	3.50	0.36	1.04	4.93
17.00	17.00	2616.64	1.64	0.0*	1-JS1f	0.75	1.26	3.50	0.48	1.77	5.89
24.00	24.00	2617.03	2.03	0.0*	1-JS1f	0.88	1.51	3.50	0.59	2.49	6.59
31.00	31.00	2617.42	2.42	0.0*	1-JS1f	1.02	1.72	3.50	0.68	3.22	7.15
38.00	38.00	2617.80	2.80	0.0*	1-JS1f	1.13	1.91	3.50	0.76	3.95	7.62
45.00	45.00	2618.19	3.19	0.34	1-JS1f	1.24	2.09	3.50	0.84	4.68	8.03
52.00	52.00	2618.60	3.60	1.05	5-JS1f	1.34	2.25	3.50	0.91	5.40	8.39
59.00	59.00	2619.05	4.05	1.85	5-JS1f	1.44	2.41	3.50	0.97	6.13	8.71
60.00	60.00	2619.11	4.11	1.97	5-JS1f	1.45	2.43	3.50	0.98	6.24	8.76
73.00	72.26	2620.02	5.02	3.60	5-JS1f	1.61	2.66	3.50	1.09	7.51	9.28
80.00	73.05	2620.08	5.08	3.77	5-JS1f	1.62	2.68	3.50	1.15	7.59	9.53

Display Geometry Plot

Crossing Summary Table Inlet Elevation: 2615.00 ft

Culvert Summary Table Culvert 1 Outlet Elevation: 2598.00 ft

Water Surface Profiles Culvert Length: 111.31 ft

Tapered Inlet Table Culvert Slope: 0.1545

Customized Table Options... Inlet Crest: 0.00 ft

 Inlet Throat: 0.00 ft

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles Options...

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 2001+91

Crossing Data - Station 2001+91

Crossing Properties		
Name: Station 2001+91		
Parameter	Value	Units
DISCHARGE DATA		
Minimum Flow	0.00	cfs
Design Flow	6.00	cfs
Maximum Flow	15.00	cfs
TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	2.00	ft
Side Slope (H:V)	2.00	-:1
Channel Slope	0.2700	ft/ft
Manning's n (channel)	0.0300	
Channel Invert Elevation	2563.00	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.00	ft
Crest Length	100.00	ft
Crest Elevation	2576.00	ft
Roadway Surface	Paved	
Top Width	36.00	ft

Culvert Properties		
Culvert 1		
Add Culvert		
Duplicate Culvert		
Delete Culvert		
Parameter	Value	Units
CULVERT DATA		
Name	Culvert 1	
Shape	Circular	
Material	Corrugated Aluminum	
Diameter	1.50	ft
Embedment Depth	0.00	in
Manning's n	0.0310	
Culvert Type	Straight	
Inlet Configuration	Thin Edge Projecting	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	2572.50	ft
Outlet Station	70.00	ft
Outlet Elevation	2563.00	ft

Help Click on any icon for help on a specific topic Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	2572.50	0.00	0.0	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
1.50	1.50	2573.11	0.61	0.0*	1-S2n	0.31	0.46	0.31	0.12	5.80	5.70
3.00	3.00	2573.41	0.91	0.0*	1-S2n	0.43	0.66	0.43	0.18	7.05	7.23
4.50	4.50	2573.70	1.20	0.0*	1-S2n	0.54	0.81	0.54	0.22	7.91	8.26
6.00	6.00	2574.00	1.50	0.0*	5-S2n	0.63	0.95	0.63	0.26	8.55	9.06
7.50	7.50	2574.35	1.85	0.0*	5-S2n	0.71	1.06	0.71	0.30	9.03	9.71
9.00	9.00	2574.76	2.26	0.0*	5-S2n	0.80	1.16	0.80	0.33	9.44	10.28
10.50	10.50	2575.25	2.75	0.0*	5-S2n	0.88	1.25	0.88	0.36	9.78	10.77
12.00	12.00	2575.83	3.33	0.0*	5-S2n	0.96	1.32	0.97	0.39	9.96	11.21
13.50	12.45	2576.02	3.52	0.0*	5-S2n	0.98	1.33	0.99	0.41	10.05	11.61
15.00	12.49	2576.04	3.54	0.0*	5-S2n	0.99	1.34	0.99	0.44	10.05	11.97

Display

Culvert Summary Table Culvert 1

Crossing Summary Table

Water Surface Profiles

Tapered Inlet Table

Customized Table Options...

Geometry

Inlet Elevation: 2572.50 ft
 Outlet Elevation: 2563.00 ft
 Culvert Length: 70.64 ft
 Culvert Slope: 0.1357
 Inlet Crest: 0.00 ft
 Inlet Throat: 0.00 ft

Plot

Crossing Rating Curve
 Culvert Performance Curve
 Selected Water Profile
 Water Surface Profile Data

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 2014+36

Crossing Data - Station 2014+36

Crossing Properties			Culvert Properties		
Name: Station 2014+36			Culvert 1 Add Culvert Duplicate Culvert Delete Culvert		
Parameter	Value	Units	Parameter	Value	Units
DISCHARGE DATA			CULVERT DATA		
Minimum Flow	10.00	cfs	Name	Culvert 1	
Design Flow	76.00	cfs	Shape	Concrete Box	
Maximum Flow	90.00	cfs	Material	Concrete	
TAILWATER DATA			Span	6.00	ft
Channel Type	Trapezoidal Channel		Rise	4.00	ft
Bottom Width	6.00	ft	Embedment Depth	0.00	in
Side Slope (H:V)	2.00		Manning's n	0.0120	
Channel Slope	0.0330	ft/ft	Culvert Type	Straight	
Manning's n (channel)	0.0550		Inlet Configuration	Square Edge (90°) Headwall	
Channel Invert Elevation	2475.00	ft	Inlet Depression?	No	
Rating Curve	View...		SITE DATA		
ROADWAY DATA			Site Data Input Option	Culvert Invert Data	
Roadway Profile Shape	Constant Roadway Elevation		Inlet Station	0.00	ft
First Roadway Station	0.00	ft	Inlet Elevation	2480.00	ft
Crest Length	100.00	ft	Outlet Station	150.00	ft
Crest Elevation	2500.00	ft			
Roadway Surface	Paved				
Top Width	36.00	ft			

Help Click on any icon for help on a specific topic Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10.00	10.00	2480.73	0.73	0.0*	1-S2n	0.15	0.44	0.15	0.51	11.31	2.80
18.00	18.00	2481.09	1.09	0.0*	1-S2n	0.27	0.65	0.27	0.71	11.31	3.40
26.00	26.00	2481.39	1.39	0.0*	1-S2n	0.38	0.84	0.38	0.88	11.31	3.82
34.00	34.00	2481.66	1.66	0.0*	1-S2n	0.45	1.00	0.48	1.02	11.88	4.15
42.00	42.00	2481.91	1.91	0.0*	1-S2n	0.51	1.15	0.51	1.15	13.66	4.42
50.00	50.00	2482.14	2.14	0.0*	1-S2n	0.57	1.29	0.61	1.26	13.69	4.65
58.00	58.00	2482.37	2.37	0.0*	1-S2n	0.63	1.43	0.63	1.37	15.26	4.86
66.00	66.00	2482.58	2.58	0.0*	1-S2n	0.69	1.55	0.74	1.46	14.81	5.05
74.00	74.00	2482.78	2.78	0.0*	1-S2n	0.75	1.68	0.80	1.56	15.35	5.21
76.00	76.00	2482.83	2.83	0.0*	1-S2n	0.77	1.71	0.81	1.58	15.57	5.25
90.00	90.00	2483.17	3.17	0.0*	1-S2n	0.86	1.91	0.92	1.73	16.25	5.51

Display

Crossing Summary Table

Culvert Summary Table **Culvert 1**

Water Surface Profiles

Tapered Inlet Table

Customized Table Options...

Geometry

Inlet Elevation: 2480.00 ft

Outlet Elevation: 2475.00 ft

Culvert Length: 150.08 ft

Culvert Slope: 0.0333

Inlet Crest: 0.00 ft

Inlet Throat: 0.00 ft

Plot

[Crossing Rating Curve](#)

[Culvert Performance Curve](#)

[Selected Water Profile](#)

[Water Surface Profile Data](#)

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 2023+46

Crossing Data - Station 2023+46

Crossing Properties			Culvert Properties		
Name:	Station 2023+46				
Parameter	Value	Units	Parameter	Value	Units
<input checked="" type="checkbox"/> DISCHARGE DATA			<input checked="" type="checkbox"/> Culvert 1	Add Culvert	
Minimum Flow	20.00	cfs		Duplicate Culvert	
Design Flow	94.00	cfs		Delete Culvert	
Maximum Flow	100.00	cfs			
<input checked="" type="checkbox"/> TAILWATER DATA					
Channel Type	Trapezoidal Channel				
Bottom Width	6.00	ft			
Side Slope (H:V)	2.00				
Channel Slope	0.1740	ft/ft			
Manning's n (channel)	0.0550				
Channel Invert Elevation	2492.00	ft			
Rating Curve	View...				
<input checked="" type="checkbox"/> ROADWAY DATA					
Roadway Profile Shape	Constant Roadway Elevation				
First Roadway Station	0.00	ft			
Crest Length	100.00	ft			
Crest Elevation	2503.00	ft			
Roadway Surface	Paved				
Top Width	36.00	ft			

Help Click on any  icon for help on a specific topic

Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
20.00	20.00	2498.27	1.27	0.0*	1-S2n	0.66	0.92	0.66	0.47	7.19	6.14
28.00	28.00	2498.52	1.52	0.0*	1-S2n	0.81	1.09	0.81	0.57	7.72	6.87
36.00	36.00	2498.75	1.75	0.0*	1-S2n	0.90	1.25	0.90	0.66	8.39	7.46
44.00	44.00	2498.94	1.94	0.0*	1-S2n	1.00	1.38	1.02	0.74	8.58	7.96
52.00	52.00	2499.14	2.14	0.0*	1-S2n	1.09	1.51	1.09	0.81	9.28	8.39
60.00	60.00	2499.33	2.33	0.0*	1-S2n	1.19	1.62	1.19	0.88	9.59	8.78
68.00	68.00	2499.52	2.52	0.0*	1-S2n	1.26	1.73	1.26	0.94	9.97	9.13
76.00	76.00	2499.70	2.70	0.0*	1-S2n	1.34	1.84	1.34	1.00	10.30	9.44
84.00	84.00	2499.88	2.88	0.0*	1-S2n	1.41	1.94	1.41	1.06	10.59	9.73
92.00	92.00	2500.06	3.06	0.0*	1-S2n	1.48	2.03	1.48	1.12	10.84	10.00
94.00	94.00	2500.11	3.11	0.0*	1-S2n	1.50	2.05	1.50	1.13	10.90	10.07

Display Crossing Summary Table Culvert Summary Table Culvert 1 Water Surface Profiles Tapered Inlet Table Customized Table Options...

Geometry Inlet Elevation: 2497.00 ft
Outlet Elevation: 2491.00 ft
Culvert Length: 90.20 ft
Culvert Slope: 0.0667
Inlet Crest: 0.00 ft
Inlet Throat: 0.00 ft

Plot Crossing Rating Curve
Culvert Performance Curve
Selected Water Profile
Water Surface Profile Data

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 2048+58

Crossing Data - Station 2048+58

Crossing Properties			Culvert Properties		
Name: Station 2048+58			Culvert 1 Add Culvert Duplicate Culvert Delete Culvert		
Parameter	Value	Units	Parameter	Value	Units
DISCHARGE DATA			CULVERT DATA		
Minimum Flow	10.00	cfs	Name	Culvert 1	
Design Flow	48.00	cfs	Shape	Circular	
Maximum Flow	60.00	cfs	Material	Corrugated Aluminum	
TAILWATER DATA			Diameter	3.00	ft
Channel Type	Trapezoidal Channel		Embedment Depth	0.00	in
Bottom Width	5.00	ft	Manning's n	0.0310	
Side Slope (H:V)	2.00	:1	Culvert Type	Straight	
Channel Slope	0.1720	ft/ft	Inlet Configuration	Thin Edge Projecting	
Manning's n (channel)	0.0550		Inlet Depression?	No	
Channel Invert Elevation	2532.50	ft	SITE DATA		
Rating Curve	View...		Site Data Input Option	Culvert Invert Data	
ROADWAY DATA			Inlet Station	0.00	ft
Roadway Profile Shape	Constant Roadway Elevation		Inlet Elevation	2534.50	ft
First Roadway Station	0.00	ft	Outlet Station	90.00	ft
Crest Length	100.00	ft	Outlet Elevation	2532.00	ft
Crest Elevation	2539.00	ft			
Roadway Surface	Paved				
Top Width	36.00	ft			

Help Click on any icon for help on a specific topic Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10.00	10.00	2535.50	1.00	0.0*	1-S2n	0.65	0.70	0.65	0.35	4.36	5.05
15.00	15.00	2535.75	1.25	0.0*	1-S2n	0.80	0.86	0.80	0.44	4.90	5.79
20.00	20.00	2535.95	1.45	0.0*	1-S2n	0.94	1.00	0.94	0.52	5.31	6.37
25.00	25.00	2536.15	1.65	0.0*	1-S2n	1.05	1.12	1.05	0.59	5.63	6.85
30.00	30.00	2536.34	1.84	0.0*	1-S2n	1.17	1.23	1.17	0.66	5.90	7.26
35.00	35.00	2536.51	2.01	0.0*	1-S2n	1.27	1.34	1.27	0.71	6.15	7.62
40.00	40.00	2536.69	2.19	0.0*	1-S2n	1.37	1.44	1.37	0.77	6.37	7.94
45.00	45.00	2536.86	2.36	0.0*	1-S2n	1.47	1.53	1.47	0.82	6.55	8.23
48.00	48.00	2536.96	2.46	0.03	1-S2n	1.52	1.58	1.52	0.85	6.66	8.40
55.00	55.00	2537.20	2.70	0.39	1-S2n	1.65	1.70	1.65	0.92	6.88	8.75
60.00	60.00	2537.38	2.88	0.76	1-S2n	1.75	1.77	1.75	0.96	7.02	8.98

Display **Geometry** **Plot**

Crossing Summary Table Culvert Summary Table **Culvert 1** Water Surface Profiles Tapered Inlet Table Customized Table Options... Inlet Elevation: 2534.50 ft Outlet Elevation: 2532.00 ft Culvert Length: 90.03 ft Culvert Slope: 0.0278 Inlet Crest: 0.00 ft Inlet Throat: 0.00 ft Crossing Rating Curve Culvert Performance Curve Selected Water Profile Water Surface Profile Data

* Full Flow Headwater elevation is below inlet invert. Outlet Control: Profiles Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 2051+60

Crossing Data - Station 2051+60

Crossing Properties			Culvert Properties		
Name: Station 2051+60			<input type="button" value="Culvert 1"/> <input type="button" value="Add Culvert"/> <input type="button" value="Duplicate Culvert"/> <input type="button" value="Delete Culvert"/>		
Parameter	Value	Units	Parameter	Value	Units
DISCHARGE DATA			CULVERT DATA		
Minimum Flow	10.00	cfs	Name	Culvert 1	
Design Flow	23.00	cfs	Shape	Circular	
Maximum Flow	100.00	cfs	Material	Corrugated Steel	
TAILWATER DATA			Diameter	2.50	ft
Channel Type	Trapezoidal Channel		Embedment Depth	0.00	in
Bottom Width	4.00	ft	Manning's n	0.0240	
Side Slope (H:V)	2.00	:1	Culvert Type	Straight	
Channel Slope	0.4500	ft/ft	Inlet Configuration	Beveled Edge (1:1)	
Manning's n (channel)	0.0300		Inlet Depression?	No	
Channel Invert Elevation	2529.00	ft	SITE DATA		
Rating Curve	View...		Site Data Input Option	Culvert Invert Data	
ROADWAY DATA			Inlet Station	0.00	ft
Roadway Profile Shape	Constant Roadway Elevation		Inlet Elevation	2536.00	ft
First Roadway Station	0.00	ft	Outlet Station	80.00	ft
Crest Length	100.00	ft	Outlet Elevation	2529.00	ft
Crest Elevation	2540.50	ft			
Roadway Surface	Paved				
Top Width	36.00	ft			

Help Click on any icon for help on a specific topic

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10.00	10.00	2537.38	1.38	0.0*	1-S2n	0.65	1.06	0.65	0.21	9.81	10.86
19.00	19.00	2538.06	2.06	0.0*	1-S2n	0.91	1.48	0.91	0.30	11.66	13.58
23.00	23.00	2538.34	2.34	0.0*	1-S2n	1.02	1.63	1.02	0.34	12.24	14.48
37.00	37.00	2539.58	3.58	0.0*	5-S2n	1.34	2.06	1.34	0.45	13.82	16.94
46.00	44.81	2540.52	4.52	0.08	5-S2n	1.51	2.22	1.51	0.51	14.42	18.17
55.00	45.39	2540.60	4.60	0.29	5-S2n	1.53	2.23	1.53	0.56	14.39	19.23
64.00	45.79	2540.66	4.66	0.38	5-S2n	1.54	2.24	1.54	0.61	14.48	20.15
73.00	46.13	2540.70	4.70	0.46	5-S2n	1.54	2.25	1.55	0.66	14.45	20.98
82.00	46.43	2540.74	4.74	0.53	5-S2n	1.55	2.25	1.56	0.70	14.47	21.74
91.00	46.71	2540.78	4.78	0.59	5-S2n	1.56	2.26	1.56	0.74	14.46	22.44
100.00	46.97	2540.82	4.81	0.65	5-S2n	1.56	2.25	1.58	0.78	14.39	23.08

Display Culvert Summary Table Crossing Summary Table Water Surface Profiles Tapered Inlet Table Customized Table

Geometry
Inlet Elevation: 2536.00 ft
Outlet Elevation: 2529.00 ft
Culvert Length: 80.31 ft
Culvert Slope: 0.0875
Inlet Crest: 0.00 ft
Inlet Throat: 0.00 ft

Plot

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help

Station 2054+19

Crossing Data - Station2054+19*

Crossing Properties		
Name: Station2054+19*		
Parameter	Value	Units
DISCHARGE DATA		
Minimum Flow	20.00	cfs
Design Flow	62.00	cfs
Maximum Flow	100.00	cfs
TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	5.00	ft
Side Slope (H:V)	4.00	
Channel Slope	0.5000	ft/ft
Manning's n (channel)	0.0550	
Channel Invert Elevation	2523.00	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.00	ft
Crest Length	100.00	ft
Crest Elevation	2538.00	ft
Roadway Surface	Paved	
Top Width	36.00	ft

Culvert Properties		
Culvert 1		
Add Culvert		
Duplicate Culvert		
Delete Culvert		
Parameter	Value	Units
CULVERT DATA		
Name	Culvert 1	
Shape	Circular	
Material	Corrugated Steel	
Diameter	5.00	ft
Embedment Depth	0.00	in
Manning's n	0.0240	
Culvert Type	Straight	
Inlet Configuration	Beveled Edge (1.5:1)	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	2528.00	ft
Outlet Station	65.00	ft
Outlet Elevation	2523.00	ft

Help Click on any icon for help on a specific topic Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
20.00	20.00	2529.55	1.55	0.0*	1-S2n	0.73	1.23	0.73	0.37	10.97	8.46
28.00	28.00	2529.86	1.86	0.0*	1-S2n	0.88	1.47	0.88	0.44	11.83	9.40
36.00	36.00	2530.12	2.12	0.0*	1-S2n	1.02	1.67	1.03	0.51	12.36	10.15
44.00	44.00	2530.36	2.36	0.0*	1-S2n	1.11	1.85	1.11	0.56	13.39	10.77
52.00	52.00	2530.60	2.60	0.0*	1-S2n	1.21	2.02	1.26	0.62	13.30	11.32
60.00	60.00	2530.86	2.86	0.0*	1-S2n	1.30	2.18	1.35	0.66	13.90	11.80
62.00	62.00	2530.92	2.92	0.0*	1-S2n	1.33	2.22	1.37	0.68	14.15	11.91
76.00	76.00	2531.32	3.32	0.0*	1-S2n	1.49	2.47	1.53	0.75	14.91	12.63
84.00	84.00	2531.53	3.53	0.0*	1-S2n	1.57	2.60	1.62	0.79	15.19	12.99
92.00	92.00	2531.73	3.73	0.0*	1-S2n	1.64	2.72	1.71	0.83	15.51	13.33
100.00	100.00	2531.93	3.93	0.0*	1-S2n	1.71	2.85	1.79	0.87	15.83	13.65

Display

Crossing Summary Table

Culvert Summary Table Culvert 1

Water Surface Profiles

Tapered Inlet Table

Customized Table Options...

Geometry

Inlet Elevation: 2528.00 ft

Outlet Elevation: 2523.00 ft

Culvert Length: 65.19 ft

Culvert Slope: 0.0769

Inlet Crest: 0.00 ft

Inlet Throat: 0.00 ft

Plot

Crossing Rating Curve

Culvert Performance Curve

Selected Water Profile

Water Surface Profile Data

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 2075+23

Crossing Data - Station 2075+23

Crossing Properties		
Name: Station 2075+23		
Parameter	Value	Units
DISCHARGE DATA		
Minimum Flow	10.00	cfs
Design Flow	148.00	cfs
Maximum Flow	150.00	cfs
TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	8.00	ft
Side Slope (H:V)	3.00	:1
Channel Slope	0.3000	ft/ft
Manning's n (channel)	0.0550	
Channel Invert Elevation	2437.00	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.00	ft
Crest Length	100.00	ft
Crest Elevation	2450.00	ft
Roadway Surface	Paved	
Top Width	36.00	ft

Culvert Properties		
Culvert 1		
Add Culvert		
Duplicate Culvert		
Delete Culvert		
Parameter	Value	Units
CULVERT DATA		
Name	Culvert 1	
Shape	Circular	
Material	Corrugated Steel	
Diameter	5.00	ft
Embedment Depth	0.00	in
Manning's n	0.0240	
Culvert Type	Straight	
Inlet Configuration	Beveled Edge (1:1)	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	2442.00	ft
Outlet Station	70.00	ft
Outlet Elevation	2437.00	ft

Help Click on any icon for help on a specific topic

Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10.00	10.00	2443.10	1.10	0.0*	1-S2n	0.54	0.87	0.54	0.22	9.86	5.16
24.00	24.00	2443.73	1.73	0.0*	1-S2n	0.82	1.36	0.82	0.37	11.13	7.05
38.00	38.00	2444.21	2.21	0.0*	1-S2n	1.06	1.72	1.08	0.49	12.13	8.25
52.00	52.00	2444.65	2.65	0.0*	1-S2n	1.23	2.02	1.23	0.58	13.71	9.15
66.00	66.00	2445.09	3.09	0.0*	1-S2n	1.40	2.29	1.40	0.67	14.56	9.89
80.00	80.00	2445.48	3.48	0.0*	1-S2n	1.56	2.53	1.60	0.74	14.72	10.51
94.00	94.00	2445.83	3.83	0.0*	1-S2n	1.69	2.76	1.75	0.81	15.30	11.06
108.00	108.00	2446.18	4.18	0.0*	1-S2n	1.82	2.96	1.89	0.88	15.82	11.55
122.00	122.00	2446.52	4.52	0.0*	1-S2n	1.95	3.16	2.03	0.94	16.33	11.99
136.00	136.00	2446.87	4.87	0.0*	1-S2n	2.07	3.34	2.16	1.00	16.72	12.40
148.00	148.00	2447.20	5.20	0.17	5-S2n	2.17	3.49	2.27	1.05	17.04	12.72

Display

Crossing Summary Table

Culvert Summary Table Culvert 1

Water Surface Profiles

Tapered Inlet Table

Customized Table Options...

Geometry

Inlet Elevation: 2442.00 ft

Outlet Elevation: 2437.00 ft

Culvert Length: 70.18 ft

Culvert Slope: 0.0714

Inlet Crest: 0.00 ft

Inlet Throat: 0.00 ft

Plot

Crossing Rating Curve

Culvert Performance Curve

Selected Water Profile

Water Surface Profile Data

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 2087+14

Crossing Data - 2087+14

Crossing Properties		
Name:	2087+14	
Parameter	Value	Units
DISCHARGE DATA		
Minimum Flow	2.00	cfs
Design Flow	6.00	cfs
Maximum Flow	10.00	cfs
TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	2.00	ft
Side Slope (H:V)	2.00	:1
Channel Slope	0.3000	ft/ft
Manning's n (channel)	0.0500	
Channel Invert Elevation	2355.00	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.00	ft
Crest Length	100.00	ft
Crest Elevation	2361.00	ft
Roadway Surface	Paved	
Top Width	36.00	ft

Culvert Properties		
Culvert 1	Add Culvert	Duplicate Culvert
CULVERT DATA		
Name	Culvert 1	
Shape	Circular	
Material	Corrugated Aluminum	
Diameter	2.00	ft
Embedment Depth	0.00	in
Manning's n	0.0310	
Culvert Type	Straight	
Inlet Configuration	Thin Edge Projecting	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	2357.00	ft
Outlet Station	45.00	ft
Outlet Elevation	2355.00	ft

Help Click on any icon for help on a specific topic Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2.00	2.00	2357.69	0.69	0.0*	1-S2n	0.42	0.49	0.42	0.18	4.17	4.65
2.80	2.80	2357.83	0.83	0.0*	1-S2n	0.50	0.58	0.50	0.22	4.56	5.20
3.60	3.60	2357.95	0.95	0.0*	1-S2n	0.57	0.66	0.57	0.25	4.80	5.63
4.40	4.40	2358.06	1.06	0.0*	1-S2n	0.63	0.74	0.63	0.29	5.17	6.00
5.20	5.20	2358.17	1.17	0.0*	1-S2n	0.69	0.80	0.69	0.31	5.39	6.32
6.00	6.00	2358.28	1.28	0.0*	1-S2n	0.75	0.87	0.75	0.34	5.60	6.60
6.80	6.80	2358.38	1.38	0.0*	1-S2n	0.80	0.92	0.80	0.36	5.77	6.86
7.60	7.60	2358.49	1.49	0.0*	1-S2n	0.85	0.98	0.85	0.39	5.95	7.09
8.40	8.40	2358.59	1.59	0.0*	1-S2n	0.90	1.03	0.90	0.41	6.11	7.30
9.20	9.20	2358.69	1.69	0.0*	1-S2n	0.95	1.08	0.95	0.43	6.25	7.50
10.00	10.00	2358.79	1.79	0.0*	1-S2n	1.00	1.13	1.00	0.45	6.38	7.69

Display

Culvert Summary Table Crossing Summary Table

Water Surface Profiles

Tapered Inlet Table

Customized Table

Options...

Geometry

Inlet Elevation: 2357.00 ft

Outlet Elevation: 2355.00 ft

Culvert Length: 45.04 ft

Culvert Slope: 0.0444

Inlet Crest: 0.00 ft

Inlet Throat: 0.00 ft

Plot

Crossing Rating Curve

Culvert Performance Curve

Selected Water Profile

Water Surface Profile Data

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close

Station 2089+35

Crossing Data - Station 2089+35

Crossing Properties			Culvert Properties		
Name: Station 2089+35			Culvert 1		
Parameter	Value	Units			
<input checked="" type="radio"/> DISCHARGE DATA			Add Culvert		
Minimum Flow	10.00	cfs	Duplicate Culvert		
Design Flow	51.00	cfs	Delete Culvert		
Maximum Flow	60.00	cfs			
<input checked="" type="radio"/> TAILWATER DATA					
Channel Type	Trapezoidal Channel				
Bottom Width	6.00	ft			
Side Slope (H:V)	3.00	:1			
Channel Slope	0.2300	ft/ft			
Manning's n (channel)	0.0550				
Channel Invert Elevation	2345.00	ft			
Rating Curve	View...				
<input checked="" type="radio"/> ROADWAY DATA					
Roadway Profile Shape	Constant Roadway Elevation				
First Roadway Station	0.00	ft			
Crest Length	100.00	ft			
Crest Elevation	2356.00	ft			
Roadway Surface	Paved				
Top Width	36.00	ft			

Help Click on any  icon for help on a specific topic

Energy Dissipation Analyze Crossing OK Cancel

Culvert Summary Table - Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10.00	10.00	2351.37	1.37	0.0*	1-S2n	0.69	1.00	0.69	0.28	8.15	5.14
15.00	15.00	2351.74	1.74	0.0*	1-S2n	0.85	1.23	0.86	0.36	8.98	5.90
20.00	20.00	2352.09	2.09	0.0*	1-S2n	0.99	1.44	0.99	0.42	9.85	6.49
25.00	25.00	2352.44	2.44	0.0*	1-S2n	1.11	1.61	1.11	0.48	10.46	6.99
30.00	30.00	2352.79	2.79	0.0*	1-S2n	1.23	1.77	1.23	0.53	10.95	7.41
35.00	35.00	2353.15	3.15	0.0*	5-S2n	1.34	1.92	1.34	0.58	11.42	7.78
40.00	40.00	2353.55	3.55	0.0*	5-S2n	1.45	2.06	1.45	0.63	11.81	8.11
45.00	45.00	2353.99	3.99	0.0*	5-S2n	1.56	2.19	1.58	0.67	11.88	8.41
50.00	50.00	2354.48	4.48	0.42	5-S2n	1.66	2.30	1.67	0.71	12.33	8.69
51.00	51.00	2354.59	4.59	1.01	5-S2n	1.68	2.32	1.69	0.72	12.40	8.74
60.00	60.00	2355.64	5.64	2.31	5-S2n	1.87	2.50	1.89	0.78	12.79	9.18

Display

Crossing Summary Table

Culvert Summary Table Culvert 1

Water Surface Profiles

Tapered Inlet Table

Customized Table Options...

Geometry

Inlet Elevation: 2350.00 ft

Outlet Elevation: 2345.00 ft

Culvert Length: 55.23 ft

Culvert Slope: 0.0909

Inlet Crest: 0.00 ft

Inlet Throat: 0.00 ft

Plot

Crossing Rating Curve

Culvert Performance Curve

Selected Water Profile

Water Surface Profile Data

* Full Flow Headwater elevation is below inlet invert.

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Adobe PDF (*.pdf) Close